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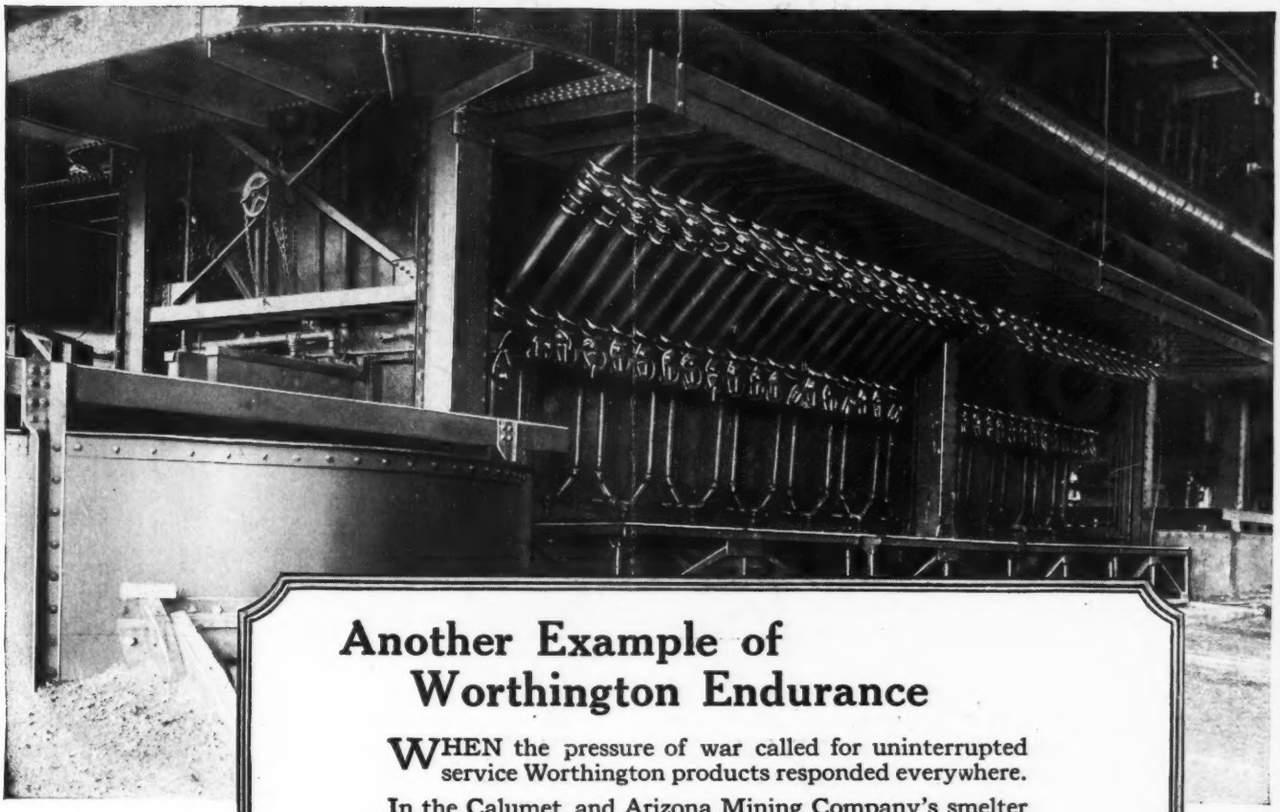

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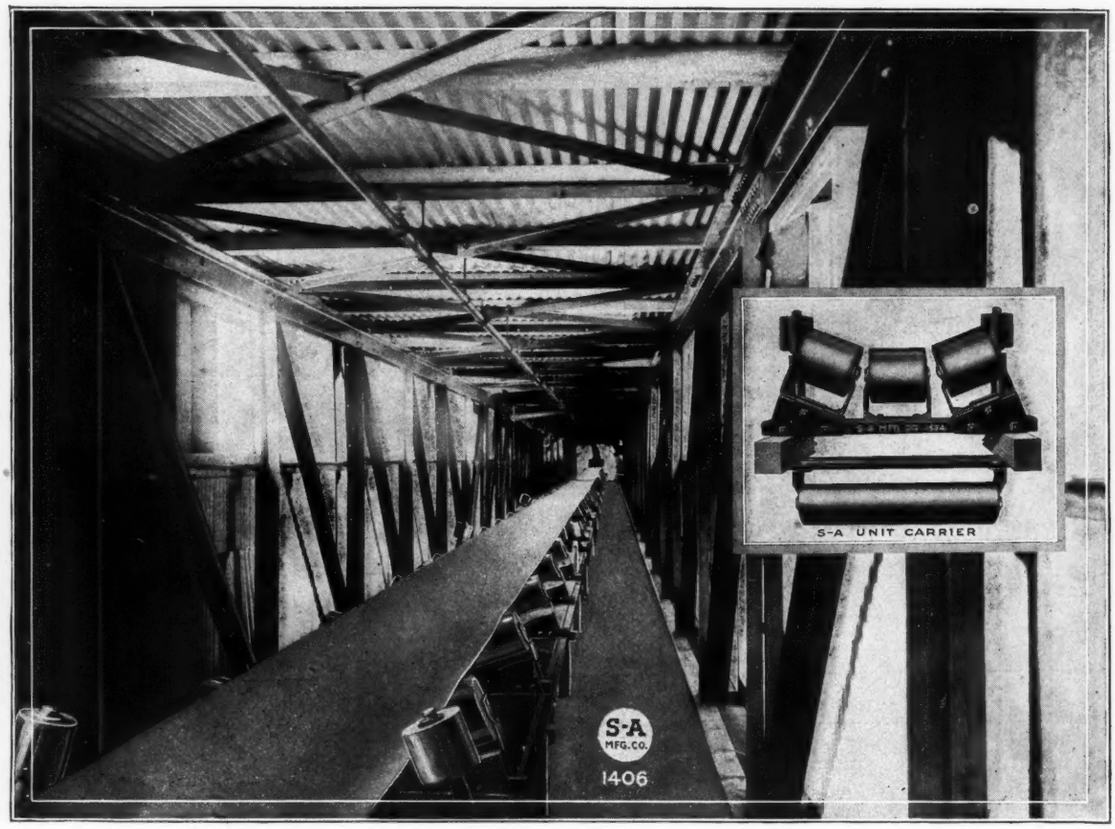


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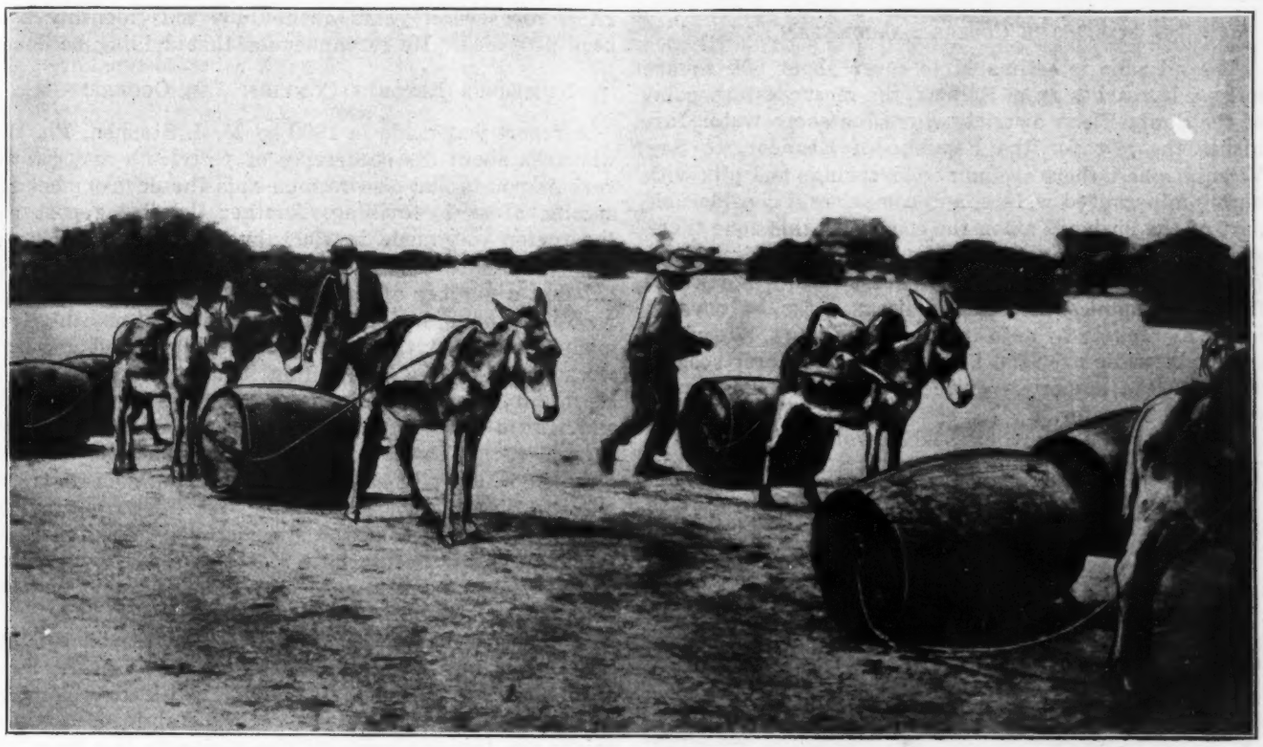


ECUADORIAN METHOD OF TRANSPORTING PETROLEUM TO THE COAST FOR SHIPMENT

# Petroleum in Ecuador


BY WALTER M. BRODIE *



*An account of the geology and occurrence of oil in Ecuador, details from a number of reports that have been submitted from time to time on the subject, and data as to the legal aspect of concessions in the republic. The author affirms that if American enterprise is to have its share in the petroleum industry of South America attention may well be directed to the coast lands of Ecuador and Peru.*


ECUADOR, situated between Colombia on the north and Peru on the south, is commercially and industrially interesting, as it has a great diversity of climate, altitude, and products. Quito, the capital, has an elevation of 9500 ft. and is 290 miles from the coast, by railroad. The coast country has a hot, dry climate, which is tempered, however, by the ocean currents which come from the cold regions of the southern hemisphere and cool the westerly winds, and by the high Andes Mountains on the east, which modify the hot breezes from the opposite direction.

For many years the existence of petroleum along the southwest coast of Ecuador has been known, and it has been produced in small quantities for half a century. The Bay of Guayaquil, or Bay of Ancón, as it is sometimes called, divides the coast country of Ecuador from that of Peru. Oil fields are found both north and south of this bay. The principal city in the neighborhood is Guayaquil, with about 60,000 inhabitants. It is the principal port of the country, and a center of commercial activity.

The best-known oil fields on the coast of Ecuador lie on the peninsula of Santa Elena, about 100 miles west from the city of Guayaquil. Coast steamers connect with the small port of Ballenita, just north of the promontory, and the locality can also be reached by automobile or on horseback during the dry season. The region has been described in a geography written by the German geologist Wolf, which was published in Leipzig in 1892 under the auspices of the government of Ecuador. Wolf holds (and D. Clerc, a French engineer, who


*Mining engineer, 47 Cedar St., New York.

reported on the Santa Elena oil fields in 1909, confirms his contention) that the surface of the ground near the oil pits of Santa Elena belongs to post-Tertiary formation, which is estimated by Clerc to be at least 164 ft. thick; that the underlying Tertiary formation is 325 to 650 ft. thick at least, and that this lower formation comes to the surface to the east and to the north of Santa Elena. Still further north the ridge of hills which bounds the peninsula belongs to the Cretaceous period.

### Oil Zone Covers Large Area

The oil zone is estimated to cover about 600 square miles. It reaches from Salinas, the most western point of the Santa Elena district, where the shore water furnishes the salt for the Republic of Ecuador, to San Vicente, where there are numerous springs and pits with highly mineralized waters, and comprises a considerable part of the lowlands along the coast. In this zone there are several harbors. One of the best is Ballenita, about 700 miles south from Panama and 90 miles northwest from Guayaquil, which latter distance can be covered in the dry season by auto in five or six hours, but which cannot be made overland in the rainy or winter season, owing to the numerous gulches, which are impassable when full of water.

THE GAS SPRING, "EL VOLCANCITO DE SAN VICENTE," IN THE CANTON SANTA ELENA, ECUADOR

The immediate neighborhood of Santa Elena is fairly level, with a slight inclination toward the west coast. Toward the northeast there are elevations about 140 ft. high; and here a number of gulches or cuts show that erosion has exposed the underlying Tertiary rocks. The country is dry for the greater part of the year, and good drinkable water, timber, and fuel are scarce. Water is now procured from pits, but an abundant supply could be obtained from the rivers of Olon and Menglar, if a few miles of pipe line were laid. In the oil zone of Puna water is obtained from pits and trenches, and also, when necessary, by condensation of steam. This latter method of procuring drinking water is often adopted when the only water obtainable is brackish or bad.

### Early Experimentation Failed

In 1876, President Garcia Moreno, who tried to develop a petroleum industry, started an exploration for the government and began to drill a deep hole, but a part of the machinery broke when the hole was only 50 meters deep. Soon afterward the president died, and the work was suspended and, later, abandoned. At that time oil-bearing ground was not denounceable by private parties. The government leased the oil lands. In 1892, when the Mining Code of Ecuador was revised, the new law authorized private individuals to examine and to preëmpt oil grounds, but the region of Santa Elena had been leased for 20 years; and it was not until 1908 and 1909 that claims were filed by various persons, who, little by little, took up all the available ground.

In 1908 a report was made by Edward J. Rye on the petroleum of the Bay of Ancón. He found the oil-bearing strata to be similar to and more pronounced than those of Peru, where, notably at Negritos and at Lorritos, for several years about 1400 tons monthly had been produced. He recommended that drilling be done.

### Numerous Reports Confirm Oil Occurrence

A report was made in 1909 by M. J. Stephen, Ph. D., who tells about the occurrence of petroleum and gas at various points and also recommends the development of specific areas by drilling. Another detailed report on the region was made in 1909, by the French engineer Clerc, who says that all signs are favorable, and points out that a number of shallow pits, which were dug and worked by hand, had yielded 300 tons of oil monthly for many years, that the country is healthful and good to work in and to live in, and that it has the necessary resources for a profitable industry, as it lies near the coast and within reach of the large city of Guayaquil. He says, also, that the formation of Santa Elena is Quaternary, in which oil has been found in horizontal strata lying in discordant stratification over Tertiary ground, which is strongly folded, and which consists of porous sandstones, alternating with impervious clayey schists. He mentions and describes a well-known point in the neighborhood, "El Volcancito," where the Tertiary formation has come to the surface and where oil can be seen oozing out of the ground.

M. Clerc, whose report is made with considerable care, insists on the necessity of careful investigation, points out the similarity of the region to the Peru oil areas across the bay to the south, and speaks hopefully of the future of the district. The reports of Rye and Stephen were in large measure responsible for the formation of the Ancón Oil Co., of Ecuador, Ltd., in London, which acquired several properties. Charles Maddock came to Ecuador to take charge; and soon after his arrival on one of the properties, San José, a hole was located and drilled. The work on the holdings of the Ancón Oil Co. was carried on principally in 1911 and 1912, but the property is now owned by Milnes and Williamson, who only a few months ago were operating in Santa Elena.

### Oil Found Near Coast

In 1912 another engineer, R. A. Graham, came to examine the properties of the Ancón Oil Co. and reported that the company owned 5000 acres and many options, that the prospects are good, that the location is favorable, as the distance is only 650 miles south from Panama, whereas the California fields are 3100 miles north of Panama; that extensive properties can be secured in Ecuador more easily than in California; that the oil, being near the coast, needs no long pipe lines for transportation, and that there is a good market, especially for fuel oil, in Ecuador and in other accessible parts of South America. He also recommends drilling.

In 1914, Charles Maddock, who had previously been with the Ancón Oil Co., reported on the Santa Elena region. He stated that one well had been sunk to a depth

of 2000 ft., the only deep well up to date; that at 1700 ft. a petroleum was found which gave a 30% motor oil, as analyzed in Paris; that the sandstones and shales are similar to those of Peru and belong to the Miocene period; that in Peru, notably at Negritos and Torritos, oil has been produced for years at the rate of 14,000 tons per month, and that the Negritos deposit has been worked for 30 years. He stated also that the Ecuador oil fields, if intelligently developed, will eventually be as important as those further south, and will be able to compete with other oil fields of the world which now furnish petroleum to South America.

### Mining Taxes Are Low

In Ecuador the mineral rights are separate and distinct from the surface rights. A title to mining property grants perpetual and exclusive ownership, as long as the mining tax is paid and the mining law is observed. The mining tax thus far has been low, and the result has been that nearly all the promising ground has been taken up by private interests. Concessions have been applied for at various times, but have not been granted. In 1917 several petitions were presented by well-known oil operators for the unoccupied ground which had not been acquired privately. The Congress of Ecuador would not grant the rights requested, but simply passed a resolution, authorizing the executive government to legalize the matter, and, in accord with certain specified conditions of the resolution, to grant a concession. The press of the country immediately raised a cry, and the president of the republic, Dr. Bagueviza, who is opposed to all monopolies, objected to the resolution, which was not insisted on by Congress.

According to the constitution of the country, when Congress passes a law the executive government has the right to object and to present its reasons for doing so. If Congress accepts these views, the law does not pass. If Congress insists, the president has to promulgate the law and to see that it is enforced. Congress is renewed every two years. The majority of the country is opposed to all monopoly. The Mining Code dates from 1886 and it was revised in 1892. It has not been changed since. The reforms of that date give to individuals the right to denounce oil lands. The mining law may be changed, but no future law can abrogate the present ownership of property. The only tax on mining is the "patent" or mining tax, which must be paid whether the mining property is being worked or not. If the tax is not paid, the mine is sold by public auction. Any excess resulting from such sale over the amount due, after paying the taxes, goes to the owner. (Article 13 of the Mining Code.)

At present the mining tax amounts to 8 *sucres* per *pertenencia*, or claim of 200,000 square meters, or 20 hectares; so that a *mina*, or mining field of maximum size, of 20 *pertenencias*, or 400 hectares, pays 100 *sucres* yearly. A *sucre* is equal to about 50c., U. S. currency. Assuming that an acre contains 4000 square meters, a mining property of 400 hectares, or 1000 acres, pays about $80, U. S. currency, per year. The owner of the subsoil has rights of preference, but has to indemnify the owner of the surface. In the oil regions of Ecuador, however, the surface is not valuable, as the country there is mostly dry and barren.

Mines and their products are exempt from other taxes for a period of 20 years. Machinery and mining tools are exempt from duties, and sales of mines and mining contracts do not pay taxes, either fiscal or municipal, for the same length of time.

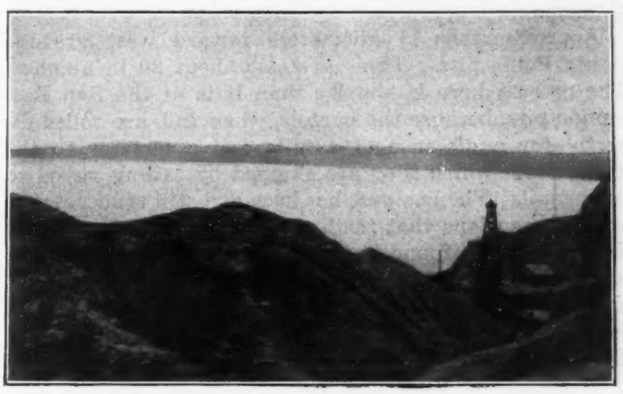
When in 1892 the Mining Code was revised, this exemption was granted for 25 years and, therefore, was to end in 1917. Congress did not change this law, but, in compliance with a petition presented by the miners of the country, conceded in 1914 an extension of this grant for 20 years, counting from Oct. 8, 1914.

Two enterprises in active operation are mentioned in the report of M. Clerc and are working still. They extract oil from pits dug by hand, and produce about 3000 barrels of oil monthly. It is reasonable to assume that only a few enterprises can work at a profit under such conditions, and that such work can at this time be done in the old primitive way is worthy of note.

The indications of oil can be seen over a great extent of country. On the island of Puná, at the head of the bay, for instance, there are noteworthy indications of oil in several places. Even the oysters along the coast are often strongly impregnated with oil, and the water of several marshes, among others the *pozo de la lechuza* —the pit of the outlet—shows signs of oil and mineral pitch.

### Hot Springs Are Common

The denouncements or locations of claims made up to date cover virtually the whole coast of the republic.



DRILL HOLE ON THE BAY OF ANCON, ECUADOR

Unoccupied oil lands therefore lie well inland, and transportation to and from them would, under present conditions, be comparatively difficult. About 14 miles east of Santa Elena there is a mud spring, known as the little volcano of San Vicente. In Spanish-American countries, be it understood, almost any place or spot where gas, or air, or steam comes out of the ground is called a *volcan*. The cone of the *volcancito* is about 30 ft. wide and 7 ft. above the bottom of a wide and shallow valley, which is surrounded by vertical bluffs of sandstone and Tertiary schists. Mud, salty water, gas bubbles and a little petroleum are thrown up constantly. North of this there are springs of warm water with a temperature in some of over 105° Fahrenheit.

Near the village of Santa Elena there is a group of pits measuring about 10 to 15 ft. across and, in instances, 40 ft. deep, which have been worked for years, and are known as the San Raimundo property. Every morning a light wooden tripod is put up successively over each pit, and, with a hand windlass and rope, a bucket, filled by a man below, is hoisted up by other men above, until the oil which has gathered in the pit has been taken out. The oil is poured into barrels, from

which the water is drawn off and which hold about 220 kilos of oil each. The barrels are then rolled to a central point, where the oil is pumped up with a hand pump into a tank which stands 10 ft. above the ground.

### Novel Method of Barrel Transportation

From this tank the oil goes through a pipe, about 2000 meters long, to the shore, where it is again put in barrels. These are placed two by two on floats, which are pulled by a rope to the sailing vessels, which take the barrels to Guayaquil in seven or eight days for 2 *sucres* per barrel. The 20 pits produce 600 to 800 barrels per month. Some pits produce at first up to 1000 liters or, say, one ton daily. The best locations for sinking pits are those where certain signs show on the surface, produced presumably by the oil rising through small cracks in the ground. Other owners transport their oil to the coast by means of donkeys.

About two kilometers toward the southeast from Santa Elena, near Corral Viejo, there are old workings similar to the ones mentioned, with pits generally from 15 to 40 ft. deep, but in one case as deep as 70 ft. These pits still yield petroleum, but it is heavier, of a black color, and further away from the shore. The pits are not being worked now. Greater depth has not been reached, on account of water, gas, and the expense of timbering.

Approximately 1½ kilometers toward west are the Santa Paula pits. These are also about 20 in number. The process here is simpler than it is at the San Raimundo pits, because the barrels, when full, are rolled directly for a distance of a mile and a quarter to the coast, from which they are shipped by sailing vessel to Guayaquil. The business has been and still is successful.

Wolf mentions that teeth and bones of *Mastodon andium* have been found in the Pleistocene of Santa Elena, which distinctly show the age of the surface ground in that region, but the occurrence of oil in this formation is accepted as an accident, it having come up from the Tertiary formation underneath.

### Sample of Oil From Ecuador Gave A High-Grade Product

Charles Maddock in his report made in 1914 says that in the only deep drill hole made, and which he located, a depth of 2000 ft. was reached, and that at 1700 ft. petroleum was struck which, as analyzed in Paris, gave 30% motor oil and must be considered a high-grade oil. He mentions that while drilling the hole one oil stratum was penetrated, with a strong enough flow to make the oil seep up behind the lining while further drilling was in process.

It is probable that the occurrence of oil on the west coast of South America, in Ecuador and Peru, may in course of time become of considerable interest. The old way of gathering and shipping the oil however will soon be superseded.

A statement made by Sir Boverton Redwood, of London, in regard to the petroleum from shallow depth at Santa Elena says:

"Color: Very dark. Red brown. Specific gravity at 60° F., 0.937; point of inflammability, 156° F.; sulphur, 0.25% calorific value 10,790 calories, or 12,420 B. t. u.

"The percentage of commercial products contained is as follows: Kerosene (sp.gr. 0.843), f.p. 105° F., 19.2%; oil, intermediate and lubricating, 66.2%; carbon, coke, 8.7%; loss, 5.9%. Rectane and ostane probably were lost while the oil was rising through the porous strata from a lower deposit."

If American enterprise is to have its share in the petroleum industry of South America, the time has come to give the coast lands of Ecuador and Peru careful attention, not by finessing for government concessions, but by a thorough study of the ground and a close examination of present conditions of ownership and of the laws affecting the industry. European countries have already given this matter some attention, and probably will keep up their activities so as to secure as large a part as possible of the supply and of the market of this important product.

## League Wants Licensed Assayers

British Columbia Correspondence

The Free Miners' League of Prince Rupert has presented a petition to the provincial government asking that the Minister of Mines appoint licensed assayers at central points throughout the province. It also requests that the holder of a Free Miners' certificate, when purchasing his license, shall receive five assay coupons, each of which, on presentation to a district assayer, shall entitle him to one assay at half the current charge. These coupons, it is suggested, should be made valid only for the year in which they were issued.

## Correspondence From Venezuela

To stimulate the mining industry of Venezuela by providing protection for investments is the intention of the government of General Juan Vincente Gomez, which is putting forth every reasonable effort to that end, according to reports from those familiar with the situation. The government at present has no jurisdiction over the state courts, and, in common with other Pan-American states, one of the difficulties to development of the mining industry is over-legislation and the fact that mining laws are changed every year or so. A mining law prepared under expert advice and guaranteed for a period of, say, 25 years would attract capital and develop the country. It is necessary that the present laws be modified if the oil lands are to receive proper development and the national interests are to be protected.

## Labor in Arizona Camps

Warren Correspondence

Arizona camps report insufficient labor generally in regard to miners and mechanics. Though the Jerome district has been practically shut down owing to the curtailment at the United Verde and United Verde Extension properties, the camps of Globe and Bisbee cannot get men enough. The reason given is that a large number have gone to the Ranger oil fields in Texas. There is an oversupply of engineering and clerical men, and also of timekeepers, but it is reported draftsmen are difficult to obtain. In no case, however, has a company refused to reinstate a man who left its employ to enlist in any branch of the service. The Inspiration Copper Co., at Miami, has put on development work every man who was qualified, as this company has found it necessary to do a large amount of development to maintain the ore supply.

# The Geology and Economics of Coal

By J. R. FINLAY*

*A comprehensive and lucid monograph by an experienced writer and engineer, who discusses the geological aspect of coal formation, the occurrence and location of peat swamps, the extent of existing deposits, and the main features of the coal-forming period. Geological processes and geographical changes are considered, and the paper, which is to appear in a revised edition of the author's treatise on "Cost of Mining," is concluded with pertinent statistics on coal consumption and distribution.*

MODERN civilization is propelled by the annual combustion of more than 1,200,000,000 tons of coal. This vast use of power, other than human or animal muscle, is the basic fact in the mightiest revolution in industry, in art, and in habits that the human race ever experienced. Every time one presses a button to turn on an electric light, every time he enters an elevator or a street car, he participates not only in a human revolution, but in a great geologic fact; for the mining and destruction of coal removes some of the important strata of the earth's crust.

Coal mining is the basis and dependence of other kinds of mining, just as it is of other industries, and, also, it is one of the simplest and commonest of mining operations, and serves as a standard by which the complexity and cost of other forms of mining may be appraised.

If coal were not so abundant and so widely distributed by nature, its use could not, of course, be so extensive and fundamental. The fact of its extensive distribution is the most powerful element in the conduct of the business of mining and selling coal. If it were not cheap it would not be so extensively used; it would not, therefore, be so valuable. But because it is cheap it is often wasted. It is cheap because it can be offered in the market by innumerable competitors, whose aim is not the wise use of coal, but ready-money profit from it. Hence this most valuable of mineral resources has been in considerable measure crudely and greedily exploited.

## Present Time Is Coal-Forming Age

The subject of the origin, history, and distribution of this substance is simple enough to be understood easily by any one willing to give it attention; but at the same time it involves facts that are hard to grasp about the changes that have taken place, and are still taking place, on the earth's crust. Coal is being formed at the present day in immense quantities over extensive areas. The present age is therefore a coal-forming age; but whether conditions are favorable for burying it under accumulations of sediment, so that the coal now being formed may be preserved indefinitely in the earth's crust, and whether the formation of coal is more general in this age than in past geological ages, or less so, are questions not easily answered. Coal is nothing but buried peat; coal formations are nothing more than a series of swampy land surfaces that were finally buried in a variety of ways under sediments.

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Peoples living in certain areas of the Anglo-Saxon world, for instance those of the southwestern half of the United States, of the whole of Australia, and of South Africa, may never have seen a peat bog or have any clear idea of what it is like. To them it may be a matter of surprise to learn that the natural surface of the earth, north of a line drawn across North America from Vancouver Island to New York City, and across Europe and Asia from Paris to Moscow to Vladivostok, is occupied to a considerable percentage of its area by peat bogs. How large the percentage is I do not know: to find out would involve mapping 8,000,000 or 9,000,000 square miles of land in a solid block occupying the subarctic and north temperate zones of the northern hemisphere. In all this vast space, wherever the climate is damp enough or the lowlands are partly flooded, mosses and semi-aquatic trees, like cedar, tamarack and alder, spread over the surface, holding and absorbing water like a sponge. The trees and plants live and die partly immersed in water. When they fall they are, in large part, covered with water, and this preserves them indefinitely from decay. A woody, or at least a vegetable, mass accumulates for ages, until it finally forms a "muck" of almost indefinite depth, always completely saturated with water under the spongy covering of moss. The moss, indeed, seems like a carpet spread over the surface of a lake; the traveler sinks in it to his knees, and although he sees before him the prospect of a wide plain or meadow, he finds its surface trembling under his footsteps for yards around. If he has the bad luck to step into a water hole, or break through the mossy carpet, he instantly mires in vegetable ooze, which may be 100 ft. deep. Such are the "tundras" of Siberia and Alaska, the "muskegs" of Canada, the "tamarack swamps" of Michigan, the bogs of Massachusetts and of Ireland, and the marshes of Germany and Russia. I am sure that the area of these swamps is far greater than that of all the coal fields of the world together. The vegetable ooze and the mat of preserved wood is peat. It is incipient coal. It constitutes in itself an inconceivably great potential fuel supply, at present only casually used because it cannot compete with the more convenient and desirable fuels that may be cut from the forest or dug out of the rocks.

## Abundance of Peat Not Universally Recognized

These northern marshes are not the only places where peat accumulates. The cypress swamps of Arkansas and Louisiana, the "Dismal Swamp" of Virginia, the mangrove swamps of tropical tide flats, are also receptacles for such vegetable ooze; but in general the south temperate and tropical zones are not favorable for their formation. The hot sun quickly dries up a swamp unless it is replenished by a constant supply of water. Even an occasional drought will expose the vegetable mass to rapid destruction by oxidation or rotting. In a dry climate, therefore, or in one in which the rainy seasons alternate with prolonged droughts, the process is impossible except under unusual circumstances. That is why so many people may live and die without knowing what peat is, although it is really so abundant.

The mere growth of peat on the surface does not lead to the formation of coal. To complete the process it is

necessary to bury the peat under sediments. The conditions that favor such burying are not by any means so common as those which permit of the accumulation on the surface. Undoubtedly most of the peat that forms is eventually destroyed again without ever being buried. A change of climate or of drainage easily puts it in the way of destruction.

The manner in which peat swamps may be effectively buried is well worth consideration. It is really a matter of common geography. Every schoolboy knows about the dikes of Holland and the levees of New Orleans, and that these dikes are to protect large areas from overflow either by the tide or by the river floods, or by both. Both tracts are in the deltas of large rivers—the Rhine and the Mississippi. When a river builds a delta into the margin of the ocean it raises a flat pile of mud higher and higher, and the river itself debouches right on top of the pile, and usually sends its waters trickling in smaller or larger streams down the sides of it in all directions.

### The Burial of Peat Swamps

The banks of the main river and of each branch are invariably higher than the country between the branches—at least they become so sooner or later. Eventually a stream will break through one of these banks and start a new channel in the hollow between old channels and in time fill it with silt to a point higher than the old channels, which, in their turn, become low ground. Supposing such hollows to be filled with peat swamps, these swamps would sooner or later be covered by the river muds, and the peat would in time become a coal bed.

The Rhine delta is actually in a peat-forming climate today; and, if it were not for the interference of civilization, nearly the whole of Holland and a good part of Belgium and Friesland would be a coal-forming region on no mean scale. All that would be necessary would be the continuance of the present climate and a maintenance of the present sea level; or, better still, a slow subsidence of the delta at approximately the rate at which the river can fill it up. The peat swamps might grow deeper indefinitely, always keeping their surface up to the level, or slightly above the level, of the river channels, thus helping to maintain those channels for long periods. In this manner the rivers would slowly build their beds and banks higher and higher, and build out deltas further and further. The waves and shore currents would spread the mud in bars and beaches along the shores of the delta and enable the beaches to creep further out into the sea. As they crept out the peat bogs would follow them. Thus the whole area of the delta between the river channels and the sea beaches would be filled with enormous accumulations of peat, interrupted, of course, by occasional patches where overflows would pour in mud, by other patches where the water would become too deep for the swamp plants and thus make lakes, or by sand dunes blown up from the beaches. If the subsidence of the delta should become too rapid for the river to maintain it, the sea would finally break through the beaches and begin flooding the swamps with salt water, killing the growth and immediately beginning to cover the peat with beach sands and sediments. The shallow bottoms of the bays would be occupied by marine animals and plants. If the water were not muddied by a constant supply of fresh silt, a limestone might be deposited instead of mud. Still further a portion of the peat bogs might be rapidly covered by a march of sand dunes blown from the beaches.

Thus, in the case of a large river delta in a damp, cool climate, it is clear that there might be deep and extensive deposits of peat and that these deposits would, in the course of time, under stable conditions, be covered either by river mud, marine sediments, or by wind-blown sand. It is also apparent that a whole delta might be covered by an acceleration of the subsidence, but when the subsidence ceased, or slowed up, a new delta would form on top of the old one, and as it grew out would cover up the old one to the new level of the sea, or of the new delta. New peat swamps would form on the new surface, which, by the way, would also extend further up the river valley and back over the lower slopes near the shore. Thus the process would go on until some radical change in the earth's crust put an end to the formation of the delta, or changed the climate so that peat swamps would no longer grow.

If Louisiana had the climate of Michigan it would be possible to see all these operations going on in this country on a huge scale. From Cairo, Ill., to the Gulf, and for vast stretches along the Gulf of Texas, Louisiana, Mississippi, Alabama, and Florida, there would be interminable peat deposits, all in process of gradual burying in the ways I have indicated, and it is my conclusion that such deposits might easily be on a scale equal to anything known in the great coal beds of the world. For instance, the Pittsburgh coal seam is believed to have been continuous over an area of 10,000 square miles; and it is reasonable to expect that, with no change whatever in conditions other than to substitute the climate of the Great Lakes, a continuous peat swamp would form on the Mississippi delta over even a greater area. The total area of lowlands in which swamp formation would be continuous and active must be more than 100,000 square miles.

If this climate and these conditions were to continue indefinitely, and if the weighting of the delta caused a slow subsidence, the coal-forming process would eventually spread over an immense area. A subsidence of 500 feet, an extremely moderate earth movement, geologically speaking, if accomplished slowly, would cause the active delta and the peat-forming area to march progressively up the valleys beyond Kansas City, Chicago, and Pittsburgh, leaving behind in the lower basin innumerable deposits of peat at different levels, covered by a deep and ever-deepening mass of sediments. Over the site of New Orleans, limestone beds would now be forming and beneath them great coal measures, and no doubt oil and gas rocks also would be securely locked. Such a development would be the counterpart of the great coal formation of the Carboniferous period, not, of course, at the same places, but on an equivalent scale.

### Geological Processes Involve Phenomenal Time Periods

This, of course, is only a rude sketch of the major features of a coal-forming period. There are innumerable variations of details of all kinds; but, in general, one may see in any coal mine an actual record of just such happenings. I have said that any observer who gives the matter attention can readily grasp the general features of this process; but there ought, perhaps, to be added one qualification or explanation. To form a conception of what is involved in the coal-forming proc-

ess it is necessary to dissociate one's imagination from the limitations of human experience. It is difficult to picture the life scale of the earth instead of the life scale of a man. A generation seems a full cycle, and it is hard to get fully away from that conception of time; but to think effectively of geological processes one must banish that limitation completely.

The span of human life, or even the whole period of recorded history, is such an insignificant fraction of time that the geological processes have made only trivial changes in geography during the whole of it. A coal-forming epoch such as I have attempted to picture must be measured in millions of years, rather than in thousands, and yet it constitutes only a modest portion of geological history. In North America, fortunately, the coal beds still remain, and they have been remarkably well preserved, too, by three such general coal-forming periods, all on a truly colossal scale, besides several others of minor importance. The publications of the U. S. Geological Survey and of many of the state surveys are full of information about this subject, a bulk of literature, indeed, too great for digestion, but for a general view one may read two volumes, *Bulletin* 38 of the U. S. Bureau of Mines, by White and Thiessen, and Professional Paper 100 A, of the U. S. Geological Survey, by Campbell, on the coal fields of the United States. Even these discussions are scarcely adequate, for they deal only with this country. A general review of the coal resources of the world was made by the International Geological Congress at the Montreal meeting in 1913. These publications are not easily obtained by the casual reader.

As other mining methods are largely an elaboration of coal mining, and a comprehension of the characteristics and location of the principal coal fields is necessary for an understanding of the economics of mining, I am attempting to give in a few succeeding paragraphs some further generalizations on this most interesting subject.

### Formation of Coal Measures Is a Regular Geological Process

"Technically, at least," says David White, chief geologist of the U. S. Geological Survey, "coal is found in the Ordovician and Cambrian—and probably even in the pre-Cambrian—sedimentary series, where it is now represented by bedded graphite. . . . Well-developed coal has been found in the strata of every period since the Silurian. . . . At present coal is commercially mined (in the United States) from rocks of basal Mississippian (Lower Carboniferous), Pennsylvania (Upper Carboniferous), Triassic, Lower Cretaceous, Upper Cretaceous, and Tertiary ages. Some mining for fuel has been done in the Jurassic of Alaska." Thus the formation of coal is shown to be one of the regular geological processes, and it has gone on persistently in all times since plant life has existed on the globe. But it is only occasionally that conditions have occurred which are favorable to the preservation by burying, as well as for the formation of peat on a large scale. It is found that these conditions accompany cycles of world history, which have repeated themselves in general terms, though not in precise detail. These cycles have a singular bearing on the formation, preservation, and exposure of metal deposits also.

Although it is a little far-fetched to assert that a study of these broad geologic processes has an intimate bearing on the practical every-day pursuits of mining, it is not extravagant to say that it is important to those who wish to have a rational vision of economic resources, or to expect that it will have increasing weight in future explorations for minerals. One may be positive that, with industries organizing on a more and more comprehensive scale, and governments undertaking projects to harmonize and further such industries, these major geologic facts will have considerable weight in the locating of manufacturing enterprises and of trade routes. At any rate, the subject is interesting.

### Differentiation Between Natural Groups

A century ago, as soon as the observations upon the earth's crust had become expansive enough to afford a basis for generalized description, geologists (mainly English at that time) perceived that almost everywhere the sedimentary rocks were separated into several natural groups by abrupt differences of solidity and attitude. The older, harder, and more tilted or contorted rocks they called Primary, an intermediate group they called Secondary, and the more recent and less solidified group the Tertiary. These divisions have been found, by the more exhaustive and far-reaching researches of all later geologists, to be established with about the same definiteness all over the world. Broader and more detailed mapping has since added a fourth and older group, obscure to the earlier geologists because less generally exposed, but now established with the same distinctness as the others; and the principal sedimentary rocks throughout the world (omitting the recent unconsolidated materials called the Quaternary) are now divided into four great groups generally named as follows:

1. The Algonkian or Eozoic, containing the recognizable earliest vestiges of life.
2. The Paleozoic, or Old Life group, Primary.
3. The Mesozoic, or Middle Life group, Secondary.
4. The Cenozoic, or Later Life group, Tertiary.

It must be borne in mind that these divisions are not in the least arbitrary or conventional, but are clearly marked by nature. Is it not remarkable that the same differences should appear in all the continents and in both hemispheres? What has mud being washed down into a bay in Australia to do with mud in a lake in Montana? Why should not the entire series of rocks in Australia be laid down without any reference to what may happen in Montana?

### Each Stratified-Rock Group Represents Cycle in Geologic History

It appears that each of the great groups of stratified rocks represents a cycle of world history during which conditions were comparatively stable and uniform. This does not mean that minor and differential changes did not occur during and throughout these periods. The sea level oscillated more or less, just as it is doing at this moment; the processes of erosion brought about their progressive changes at all times; but during these periods these agencies proceeded along the same general lines, with regional or local instead of world-wide interruptions. In general, the progress was toward the wearing down of continental masses, the filling up of depressions, the formation of vast plains, and the development of equable climate by the leveling of those barriers, such as lofty mountain ridges, which cause abrupt changes.

In each of the great cycles the last stage was the one favorable to the formation of coal on a great scale. The continents were not only worn down almost flat, but the wearing of them down had filled up the contiguous shallow parts of the ocean, tending to raise the comparative level of the sea. Minor oscillations or warpings of the surface would thus flood or expose large areas of flat lands. The climate, being equable, was also stable for long periods; and an area wet enough to promote the formation of peat would remain so. Thus the conditions briefly outlined previously for the creation of extensive coal deposits reached perfection.

### "Revolutions" of Earth's Crust

For reasons dimly understood, or not at all, these cycles of quiescence and equilibrium were interrupted finally in each case by world-wide convulsive movements of the earth's crust, called "revolutions." These "revolutions" were not cataclysms in the sense of being sudden and overwhelming disturbances, although they were sufficiently rapid to exterminate innumerable forms of life and to produce great changes in living conditions for both plants and animals. There were no doubt violent earthquakes, always accompanied by abundant volcanic activity; but, in general, the "revolutions" were progressive and differential. The leveling forces were overcome by the forces of upheaval. Great mountain chains and plateaus were thrown up; frequently new ones, the continents in general, were raised and took new forms, the ocean beds were deepened, and the sea level retreated. In other words, there were immense changes of geography and of climate. Thus in the southern hemisphere, at the close of the Paleozoic, the mild climate of the coal-forming Carboniferous period was succeeded by a formidable refrigeration, so that in Permian time ice fields covered portions of South America, Australia, and Africa on a scale exceeding that of the recent glacial period of the northern hemisphere. This is merely an example.

The "revolution" having worked itself out, the conditions of comparative equilibrium returned, the erosive forces proceeded again with the work of leveling the uplifted continents; in short, a new cycle parallel to but not identical with the old one was under way.

The major coal formations were therefore laid down toward the end of these cycles when the continents were maturely eroded and flattened, when climate was equable and stable, and the earth's crust free from disturbances. How far these processes were carried may be gathered from a paragraph or two on the geography of the principal coal formations of North America.

### The Paleozoic Coal Fields

1. The Paleozoic coal fields extend from central Oklahoma to Massachusetts, 1500 miles in a straight line, and from Birmingham, Ala., to Cedar Rapids, Iowa, in greatest breadth 750 miles. This area contains only the remains of the original deposits, but it gives some idea of the huge, low swampy plains, so near sea level that they were repeatedly flooded by gentle oscillations of the level. It was traversed by rivers, which in all probability carried more water than the Mississippi system of today. In fact the lowlands alone, those subject to periodic or occasional overflow by the rivers or the sea, amounted to 1,000,000 square miles in a solid block.

It is not reasonable to suppose that this great tract was all of the same level, or that coal was either formed or buried simultaneously over the whole of it; rather there is evidence to point to the conclusion that through the progressive changes of sea level the whole area was affected by delta- and peat-forming conditions, which at any given time would form a broad strip immediately back of the seacoast. The actual deltas probably extended up the rivers for hundreds of miles, just as the Mississippi delta of today extends up to Cairo, more than 500 miles in a straight line from the mouth of the river, although for the greater part of that distance the delta covers only a strip on each side of the river. Whenever the sea level rose, these delta strips would retreat inland; whenever the sea level retreated, the deltas would advance. Such oscillations did take place; but, on the whole, the basin was subsiding. During the period the sediments, containing numerous separate beds of coal, accumulated to a depth of several thousand feet, the surface required for this remaining meanwhile practically at sea level, varying from 100 or 200 ft. above to 100 or 200 ft. below. To get an accurate idea of the appearance of the whole country within the area mentioned, one need do nothing more than take a look at an uncleared tract near New Orleans. The plants were actually different, but to a casual observer they would not have appeared so.

### The Pennsylvania Epoch

As to the geography outside of this plain, only a general conception is possible. Toward the north there was a large area of higher land, extending unbrokenly from central Minnesota to Labrador and perhaps beyond. To the southeast, in Georgia, South Carolina, North Carolina, and Virginia, there were, no doubt, land areas, probably large islands of moderate elevation and maturely eroded surface. Toward the west a shallow sea of clear water extended from central Texas, Oklahoma, Kansas, and Nebraska. To say that this sea covered the Rocky Mountains is inaccurate. There were no Rocky Mountains to cover. There had been mountains in that region, to be sure, but they were different mountains entirely, which had been worn down to a plain and finally immersed in the sea under discussion. Just where this sea ended toward the north and northwest I do not know, but it certainly covered nearly the whole of New Mexico, the northern part of Old Mexico, the whole of Arizona, a portion, at least, of southern California and Nevada, and most of Utah, Colorado, Wyoming, Montana, and South Dakota.

Such was, dimly, the Pennsylvania epoch in North America at the close of Paleozoic time. Marius R. Campbell estimates that the remains of the coal left on those delta plains amounts to 1,088,000,000,000 tons, over a trillion, enough to maintain the total present output of the United States for 1500 years. This coal is all of good quality and high rank, varying from bituminous to anthracite, and the tract mentioned contains more coal, by far, than the whole Continent of Europe—possibly more than the whole of Asia.

### Relative Importance of Various Coal Fields

The coal fields of Europe are at present the most important, economically speaking, excepting those of North America. The most valuable were formed during the same epoch and under analogous conditions. A similar delta plain extended, with possible, or probable, inter-

ruptions, from Ireland through Great Britain, Germany, Poland, and Russia to the Sea of Azov "The number of workable seams," say Chamberlain and Saulsbury, "is large in many places. Thus, in Westphalia the number of workable beds is said to be 90. The aggregate (maximum) thickness of the coal in Lancashire is 150 ft., and in Westphalia, 274 ft. Here, as elsewhere, beds of marine origin alternate with those which were deposited on land, in marshes, and other places."

### Coal Development Progressed After Upper Cretaceous Period

2. In North America it is a mistake to focus attention too exclusively upon the Paleozoic coal fields. At the end of the next, or Mesozoic, world cycle in Upper Cretaceous time, there was a still greater coal development. Those interested in the subject might repeat almost the same description of continental and climatic conditions, but when one comes to geography it is necessary to migrate. An immense, flat, subsiding plain so near sea level that it was repeatedly flooded with sea water extended from the Gulf of Mexico to the Arctic Ocean, right over where now are the highest mountains and plateaus of the Rocky Mountain system. The plain terminated in higher land to the eastward on a line from east-central Texas to Duluth to Winnipeg; on the west on a line from northwestern Arizona through western Utah and southeastern Idaho, northwestern Montana, and eastern British Columbia toward the mouth of the Mackenzie River. This great plain was, therefore, 3500 miles long and up to 1000 miles wide. How much of it was generally under sea water and how much above during the coal-forming age it is impossible to estimate, but it contains every kind of sediment in great volume, including shales, limestones, and sandstones. The coal seems to have formed principally in the central portion of this tract, from which it is reasonable to assume that in this area the erosion of the chief land areas to the west was sufficient to keep the basin nearly full of mud.

Coal was formed on a scale quite equal to that of the Pennsylvanian time. It remains now in New Mexico, Colorado, Utah, Wyoming, and Montana. Mr. Campbell estimates the amount available at a depth of less than 3000 ft. at 1,400,000,000,000 tons of sub-bituminous and bituminous rank, with some anthracite. Lying at a depth of from 3000 to 6000 ft., he estimates 666,000,000,000 tons more, so that the Upper Cretaceous has left a total of over 2,000,000,000,000 tons in the United States alone. Possibly a third as much more lies in Canada. Much of this coal is of excellent quality for all purposes, including large amounts suitable for good metallurgical coke.

### The Period of Vast Geologic Changes

3. At the end of this wonderful period another world "revolution" occurred, or, perhaps more accurately, began. Great geographical changes took place. Australia was permanently separated from Asia. In North America the great Cretaceous trough began to split from end to end along the line of the Front Range of the Rocky Mountains, where blocks of the hard underlying rocks were pushed up through the Cretaceous sediments like flatirons through pancakes, raising portions up bodily and crumpling other portions along their flanks. The process of slow subsidence was thus reversed, and the great trough humped up in the middle so that the whole became rather a plateau, the eastern half left undisturbed other than by a gentle tilting which made a wide slope of the Great Plains, the western edge of which are in places nearly 8000 ft. above sea level. The western half became an area of mountains and plateaus, in which the strata are generally disturbed and exposed by faulting and folding, and intruded by volcanic rocks, some of which are enormous batholiths.

Although this post-Cretaceous change was extensive enough at once to produce an abrupt unconformity between those rocks and the succeeding Tertiary formations, it was not extensive enough at first greatly to change the climate. Parts of the great trough remained lowlands and were to some extent filled by fresh water lakes, along which coal formation continued. The largest of these areas was in North Dakota, Montana, and Alberta, where the deposits were on a truly imposing scale. But these coals were never deeply covered by sediments, nor have they been affected by earth movements such as would compress and alter them. They are therefore still lignites, the first stage removed from peat, and are coals of low rank and poor quality. They would be in other countries, however, a wonderful fuel supply. Mr. Campbell estimates in this field 965,000,000,000 tons in the United States alone, much of it occurring in thick seams. Though this lignite will not make metallurgical coke, it will make gas and power. It will not stand transportation or storage well, but it can be used on the ground for electrical generation, whenever a demand shall rise for it, to good advantage.

With this exception the Tertiary coals were formed in smaller detached lake basins, or in isolated tracts along the coasts. They occur in Alabama, Mississippi, Tennessee, Arkansas, Louisiana, Texas, California, Oregon, and Washington. The aggregate amount in these fields is great, but in all the Southern States the coal lies in unconsolidated sediments and is a soft low-grade lignite. It is only in the State of Washington that one of these Tertiary fields has been so affected by earth movements as to reach bituminous and sub-bituminous rank. Owing to its position on the great harbor of Puget Sound, and to the general scarcity of coal along the Pacific, this is apparently a field of marked economic importance. Mr. Campbell estimates for it about 65,000,000,000 tons, of which probably about 80,000,000 tons have been mined.

### Coal Statistics

It appears that though the production of coal per capita is still increasing in this country, it is not doing so at the former rate. The increase between 1897 and 1907 was from about 2.77 tons per capita to about 5.6 tons per capita; from 1907 to 1917 the increase was only from 5.6 to 6.5. It might appear from this that the desire of the population for fuel is nearly satisfied. It may be assumed with certainty that a time will come when the consumption of coal will increase only in proportion to the increase of population.

The same facts are shown by the total output of the country to date. It will be remembered that up to 1907 the production was doubling each decade, so that between 1897 and that year it was nearly equal to the entire production of the country previous to 1907. From 1907 to 1917 the production was only 75% of the previous production.

Still more noticeable is the fact that the number of men employed in coal mining has not increased at the former rate. In 1897 the number was 397,000; in 1907,

680,000—an increase of 283,000 for the decade; but in 1917 the number had risen only to 750,000, an increase of only 70,000 for the decade.

Statistics show a remarkable uniformity of conditions in the coal industry up to the end of 1915. In that year the value of all coal at the mines was estimated by the U. S. Geological Survey at $1.29 per ton, almost exactly the same as shown by the tables for the years 1903-1907.

## Argentine Fuel Developments*

In an article on the Argentine petroleum industry, Dr. B. Sichel says that, though the existence of natural oil fields in the Argentine has been known for several decades, the petroleum industry, now so flourishing, had its beginning in 1907, when an engineer, Enrique Hermitte, while boring for water on the coast of the Chubat district, at the instance of the Office of Mines, Geology and Hydrology, found oil after penetration to a depth of 532 meters.

The development of the Comodoro Rivadavia oil output since 1907 has been astonishing, and justifies hopes of increasing prosperity. The output between 1911 and 1917 inclusive was as follows:

ARGENTINE PETROLEUM PRODUCTION 1911-1917

| Year | Production Tons | Year | Production Tons |
|---|---|---|---|
| 1911 | 1,926 | 1915 | 75,900 |
| 1912 | 6,860 | 1916 | 116,000 |
| 1913 | 19,050 | 1917 | 130,000 |
| 1914 | 40,530 | | |

What this output of petroleum means for the Argentine may be realized when it is remembered that profitable deposits of coal and other mineral fuel are comparatively rare. The peat bogs are not productive enough to be of much account, and although the hard timber found in the north is suitable for fuel, it is of importance only for the northern district, owing to high freight rates. The Argentine is, therefore, compelled to obtain fuel from abroad, and it forms by far the most valuable item of the country's imports. The normal demand for foreign fuel since 1913 has been: Pit coal, 4,046,278 tons, valued at 28,323,946 pesos (gold); coke, 21,317 tons, valued at 170,539 pesos (gold).

Of the total coal import, England contributed 94.4%, the United States, 3.1%, and Germany, 1.5%. There was, too, a large import of wood for fuel and also of petroleum. The amount of the latter imported in 1913 was: Refined petroleum, 68,228,658 l., valued at 2,046,860 pesos (gold); crude petroleum, 119,318,402 kg., valued at 11,931,840 pesos (gold).

The refined petroleum came exclusively from the United States; but during the war a part of it was derived from Mexico, especially from the Anglo-Mexican Petroleum Products Co. Import of coal has been largely reduced during the war years, and that of crude oil proportionately increased. The Argentine's dependence on England and the United States constituted a serious danger for the country in time of war and also during the strike of the English miners in 1912. Accordingly, a wide field was opened for the production of the country's petroleum, and since 1914, when large quantities of oil became available, it has found a ready market.

The composition of Argentine petroleum makes it especially adapted for use as fuel, containing, as it does, 2.5% benzine, 4.8% kerosene, 8.3% gasoline, 27.5% lubricating oil, and 55.1% asphalt. It is, in fact, an asphaltic oil of which the density is stated to be 0.920. It contains few volatile substances, is free from sulphur and phosphorus, and its water content never exceeds 1%. Distillation at 220° C. gives a product whose flash-point is reached at 102° C—an excellent oil for ships' boilers. The crude oil can be employed direct for boiler fuel and in Diesel motors, and develops 10,860 heat units, only 140 less than the maximum. Its heating capacity is 1½ times that of coal, 100,000 tons of crude oil being equal to 150,000 tons of coal. It is of less importance as an illuminating oil, as distillation gives a yield of only 10%, as against 40% and 70% of the Baku and Pennsylvania oils. It should, however, be remembered that borings at present are comparatively shallow, and that it is at greater depths that oils richer in volatile substances are found.

Argentine petroleum is used by the Italian Electricity Co., in Buenos Aires, and by the German Overseas Electricity Co., as fuel. It is also used in the frozen meat establishments, in mills, on the railways, especially the Patagonian government railways; in river shipping and in the navy, and will soon be used in other establishments, as transpport conditions are favorable, especially in the coastal districts.

In order entirely to replace foreign coal and petroleum, between 2½ and 3 million tons of Argentine petroleum would be required annually, and as the present output is about 150,000 tons, the industry is afforded a wide field of activity, which will remain extensive enough, when, as is intended, the output is increased to 300,000 tons. At present the yield is not nearly large enough to meet the country's requirements, and it is impossible to estimate the capacity of output of the zone. Some experts believe that the Comodoro Rivadavia contains between 930 and 1000 million cu.m., though others place it at 130,000 tons per hectare, which approximates 130 million tons per 1000 hectares. All such estimates are problematical, for up to the present only 130 hectares contain relatively shallow borings, none of which, however, has been fruitless. At all events, oil will be practically inexhaustible for many years.

*Translated from *Wirkschaftsdiensk* and abstracted from the technical supplement to the *Review of the Foreign Press*, issued by the General Staff, War Office, London.

## Mine-Dust Sampling

Tests are being conducted at the Pittsburgh station of the Bureau of Mines on the sugar-tube method of collecting dust samples from the air of metal mines, a modification of that used by Edwin Higgins in sampling dust in mines of the Joplin district. Preliminary experiments have shown that the old type of sugar tube had an extremely high resistance to breathing, amounting to from 15 to 20 in. at 16 liters per minute. This large resistance renders it impossible for a man to take a sample of appreciable size. As a result of experiments made with different dimensions of tubes, a size was found in which the resistance is reduced to only 3 in. of water at 32 liters per minute, and which is decidedly more efficient in removing fine dust.

On applying the standard tobacco-smoke test, it was found that the efficiency of the old type of sugar tubes was only 50%. That of the new type will probably be about 90%. Optical methods are used for determining the efficiency, and by such methods very fine particles can be distinguished—much finer than by any other method.

# Prominent Metallurgists

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## Standard Buildings

The *Journal* has published a number of special articles respecting standardization of underground practice, the papers having for their aim the increased efficiency obtainable through the adoption of a uniform standardized way of doing things or by using type tools and equipment.

Efficiency may be fostered not only by eliminating useless physical work, but by the conservation of the mental power of those who are in charge of operations. When it is established that a certain brand of explosive gives the best result in the quarry or mine, the manager need give the matter no further attention—he simply tells the purchasing agent to buy that quality of explosive on the most favorable terms. The same may be said of fuel and lubricants, steel and drills.

The standard building remains to be described. Mine-camp buildings are often temporary affairs; but where it is desirable to establish a community by providing for men with families, much can be accomplished by adopting a standard-type cabin. Being of uniform design, a minimum supervision in construction is necessary, and the reordering of supplies and the construction of the building are merely repetitions of earlier efforts. Of course, this method of procedure is not applicable to the permanent camp, where the miner may own his own home and build it in a manner to suit himself.

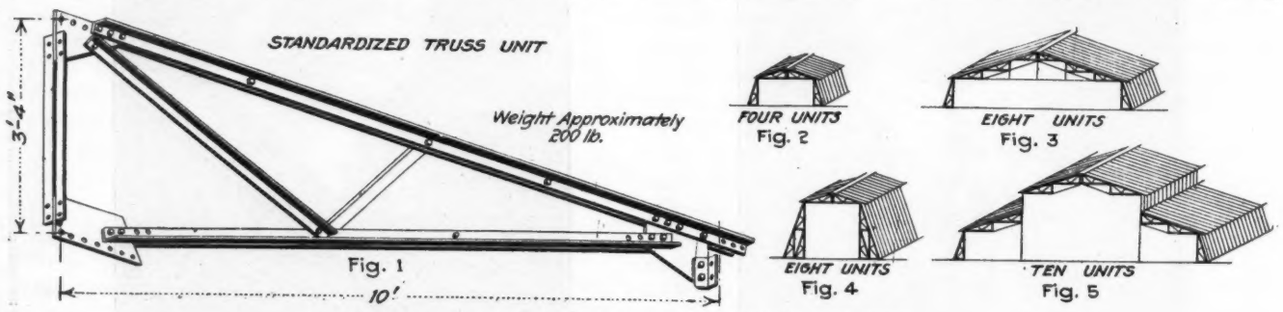
The adoption of duplicate cabins or dwellings simply means the standardization of buildings, and adds to the general economy of the mining plant. The same idea may be extended to certain of the mine or mill buildings to advantage. If the storehouse, blacksmith shop, timber mill, and stables can all be built on the same general plan, supervision expense may be reduced and the work accomplished with greater speed.

With the idea of preparing for an emergency wherein a number of simple buildings, varying little in detail, would be required at short notice, Milliken Brothers, of New York, have designed a standard truss-unit system that may be used in the construction of corrugated iron buildings of, possibly, varying form and size. Of course the machinery and the work carried on inside of such a building must be adapted to the building. The great advantage in this or any similar type of ready-to-order building is that it is always in stock, ready to ship at a moment's notice, may be put together with nuts and bolts, and every member is the duplicate of the other, so that, in the erection, expert millwrights or mechanics are not required. The Milliken unit is shown in Fig. 1. Types of construction in which it may be used are shown in Figs. 2, 3, 4, and 5.

Such construction is peculiarly adapted to foreign countries importing their equipment from the United States. It makes little difference what is lost or fails to arrive on time, the building may go on with whatever comes in, the most necessary building being the first to be erected. Moreover, the greater part of any such work may be done by any native capable of turning a spanner.

There is a field in standard mill building for some enterprising steel or iron manufacturer. In glancing over the drawings of new mill buildings erected during the last two years it will be noted that there is a great similarity in the design of at least 50% of the smaller mills, i.e. those not exceeding 200 or 300 tons' daily capacity. The same roofing and siding, the same trusses and columns might have been used in every one of these buildings without making perceptible alterations in the plans.

If it were possible to order from standard stock the covering for small mills and the support for shafting, the placing of various appliances could often be adapted to the requirements of the standard form. In many instances small mills are required in a hurry, and such standard equipment would be ordered if it was held in stock and mill builders were generally aware of its availability.




DETAILS OF STANDARDIZED TRUSS-UNIT SYSTEM

## Motor Trucks to States

More than $45,000,000 worth of motor trucks are soon to be distributed by the Secretary of Agriculture through the Bureau of Public Roads to the state highway departments. These trucks have been declared surplus by the War Department, and are being distributed to the states under the provisions of Sec. 7 of the Post Office Appropriation Bill. They must be used by the states on roads constructed in whole or in part by Federal aid, for which $200,000,000, in addition to the former appropriation, was given to the states under the same bill. All that the states must do to acquire the use of these 20,000 trucks, which range in capacity from two to five tons, is to pay the loading and freight charges. Of the 20,000 motor vehicles to be acquired practically free by the states, 11,000 are new and 9000 have been used, but all are declared to be in serviceable condition. The motors will be apportioned to states only upon request of the state highway departments on the basis of the requests received from the respective states and in accordance with the apportionment provided in the Federal aid law approved in 1916. The requirements of the law are such that the Bureau of Public Roads cannot distribute any trucks to counties or individuals.

## Benjamin G. Lamme Awarded Medal

Benjamin G. Lamme, chief engineer of the Westinghouse Electric and Manufacturing Co., was on May 16 awarded the Edison Medal by the American Institute of Electrical Engineers for "invention and development of electrical machinery." The Edison Medal was founded by an association composed of friends and associates of Thomas A. Edison, and is awarded annually for meritorious achievement in electrical science, electrical engineering, or the electric arts. The award of this medal is one of the highest honors that can be conferred upon an American or Canadian electrical engineer, and among those who have received it are George Westinghouse, Elihu Thompson, Frank J. Sprague, Alexander Graham Bell, and Nikola Tesla.

The honor of the award of the medal to Mr. Lamme follows closely his appointment to membership on the Naval Consulting Board. This appointment by the Secretary of the Navy emanated from the recommendation of the American Institute of Electrical Engineers, consisting of 10,000 members. Mr. Lamme was chairman of one of the important committees whose work had far-reaching results in the prosecution of the war.

Mr. Lamme was born in 1864 on a farm near Springfield, Ohio. His attendance at the country schools in the vicinity of his home was followed by a course in mechanical engineering at the Ohio State University, from which he was graduated in 1888. In 1889 he entered the employ of the Westinghouse company, and because of his remarkable ability his promotion was rapid; in 1900 he was made assistant chief engineer and in 1903, chief engineer, which position he has held ever since.

Mr. Lamme is not only an engineer but also a most fertile inventor, over 150 patents having been granted to him. These patents relate almost exclusively to dynamo-electric machinery, and cover motors, controllers, electrical coils and windings, rotary converters, generators, turbo-generators, and a variety of other apparatus. An unusually large number of his inventions have been put into practical use, and many of them have found world-wide application.

Among the achievements of Mr. Lamme may be mentioned the development of the alternating-current motor, the "harnessing of Niagara Falls," and the design of the equipment used in the electrification of the New York, New Haven & Hartford R.R., the Pennsylvania, the Norfolk & Western, and other prominent railroads.

Some of the papers which Mr. Lamme has read before scientific societies have become classics, especially noteworthy being a paper on the design of the induction motor, which was read before the National Electric Light Association at Niagara Falls in 1897. This, even today, is regarded as the last word in the design of alternating-current motors.

## Mineral Production of Queensland

The total value of the Queensland mineral output in 1918, according to the official report of the Queensland Under Secretary for Mines, (published in the *Queensland Government Mining Journal*), was £3,740,925, a decrease, when compared with that of 1917, of £272,052. The greater part of this decline is accounted for by the continued falling off in gold yield, which has been accentuated by the increasing cost of production incidental to war conditions, without any change in the price of the metal. In other minerals, though market prices have been high, there have been several checks in the usual output—industrial troubles in the Cloncurry and other districts, combined with high wages, high cost of materials, and of machinery.

The total gold production in 1918 was 133,571 fine oz., valued at £567,371, compared with 179,305 fine oz. in the preceding year. Silver production was 152,499 oz. in 1918 and 241,639 oz. in 1917.

Production of minerals other than gold and silver is given in the accompanying table.

MINERAL AND METAL PRODUCTION OF QUEENSLAND
(In Long Tons)

| | 1917 | 1918 |
|---|---|---|
| Tin | 1,177 | 1,311 |
| Lead | 480 | 221 |
| Coal | 1,048,473 | 983,193 |
| Copper | 19,062 | 18,979 |
| Wolfram | 353 | 249 |
| Manganese | 21 | 1,299 |
| Bismuth | 4 | 21 |
| Bismuth-wolfram ore | 131 | 114 |
| Molybdenite | 111 | 110 |
| Limestone (flux) | 135,703 | 97,898 |
| Ironstone (flux) | 25,065 | 42,782 |
| Fireclay | 10,602 | 8,306 |
| Scheelite | 9 | 17 |
| Arsenical pyrites | 32 | 66 |
| Fluorspar | 71 | ... |
| Chrome iron | 756 | 232 |

Dividends paid by the mining companies of Queensland during 1918 totaled £278,811, compared with £366,098 in 1917, a decrease of £87,287.

An important measure, the Chillagoe & Etheridge Railways Act of 1918, was passed by the Legislature during the 1918 session. Under this law the government acquires the Chillagoe Railway and Etheridge Railway (previously in the hands of the Chillagoe company), and certain other properties, including the Chillagoe Reduction Works, which have been idle for a number of years; the Einasleigh copper mine, which has also been closed down for some time, and other mines or mining leases previously held by the Chillagoe company. It is the intention of the government to restart reduction work as soon as possible, and also to make arrangements for the reopening of the mines which have come into its possession under the new act.

## Arizona Attacks Freight Rates

PHOENIX CORRESPONDENCE

The State of Arizona, through its Corporation Commission, will assist in the prosecution of a case, alleging excessive freight charges, filed against the Director General of Railroads by the Phelps Dodge Corporation, Calumet & Arizona, Old Dominion, and United Verde Extension Mining companies. A hearing will be held in Chicago on June 2, with complaint specifications covering 47 separate rail and steamship lines.

The pre-war rate on copper bullion from Douglas to New York, by rail to Galveston and thence by water, was $8.55 a ton. An initial raise of 25% was made, and then a later raise that brings the rate up to $16.50, with marine insurance added. The annual gross surcharge thus put upon the copper mines of Arizona has been estimated as reaching $4,000,000 on normal annual shipments. The producers are willing to pay the 25% addition, but protest against a doubling of the freight rate in a time when copper values have become nominal. The Ray Consolidated company has made protest also, in a separate action. Chairman Jones of the Corporation Commission will represent the state in Chicago. He states his belief that "The producers cannot pay such rates at the present low price of copper and operate to capacity, if at all, with profit."

## Italian Pig-Iron and Steel Output*

The pig-iron and steel productions of Italy in 1917, as compared with those of 1916, were as follows, according to *Revista del Servizio Minerario*:

ITALIAN PIG-IRON PRODUCTION
(In Metric Tons)

| | 1917 | 1916 |
|---|---|---|
| Coke pig iron | 410,224 | 443,464 |
| Charcoal pig iron | 4,440 | 6,630 |
| Electric pig iron | 56,524 | 17,298 |
| Totals | 471,188 | 467,392 |

ITALIAN STEEL PRODUCTION
(In Metric Tons)

| | 1917 | 1916 |
|---|---|---|
| Bessemer steel | 23,200 | 39,581 |
| Openhearth steel | 1,235,962 | 1,182,417 |
| Crucible steel | 1,290 | 710 |
| Electric steel | 36,948 | 22,376 |
| Castings | 35,441 | 24,402 |
| Totals | 1,331,641 | 1,269,486 |

The iron-ore output in 1917 is reported as 993,825 tons, compared with 942,244 tons in 1916. The 1917 manganese-ore production was 24,532 tons, as against 18,147 tons in 1916. The large production of electric pig iron in 1917 is noteworthy.

## Oil Concessions Not Transferable

According to a consular report, the issue of *El Pueblo* for Apr. 12 states that the Mexican Department of Industry and Commerce confirmed the report that the following clause appears in all concessions for the exploitation of oil properties: "This concession will be declared null for any one of the following reasons: For the transfer of this contract or any of its concessions to any foreign government or to admit it as a partner, etc." Many petroleum companies have not wished to prove the legitimacy of their rights to the properties they are working, and these companies may at any time, and in accordance with Mexican laws, lose all rights.

## Coal-Mine Fatalities in the U. S. in 1918

Complete fatality reports received from the state coal-mine inspectors for 1918, according to Albert H. Fay, of the U. S. Bureau of Mines, show a reduction of 4.5%, as compared with 1917. The total number killed was 2579 in 1918, and 2696 in 1917, a reduction of 117. There was a decrease of 233, or 64%, in fatalities from gas and dust explosions. Slight increases are shown in fatalities due to falling coal or rock, haulage, explosives, and electricity. The total number of fatalities underground due to explosives was 135, as compared with 111 for the previous year, representing an increase of 21%. The number of fatalities due to electricity was 88 in 1918, as compared with 79 in 1917. The electrical accidents underground show an increase of 11.4%, and haulage accidents show an increase of 5 per cent.

The conditions under which the mines were operated in 1918 were far from normal, by reason of the war. The demand for coal was unprecedented, and the mines were operated more nearly full time than in any previous year. Many of the experienced miners either enlisted or were drafted into the Army. Experienced foremen and safety engineers were often replaced by less experienced men. Many older men were employed in place of the younger men who entered the Army. General conditions were not, therefore, favorable for accident reduction. However, with the mines operating practically full time, this would have the tendency to prevent accumulations of gas in old workings and perhaps maintain better roof conditions than would be found in mines operated only part time.

*Extracted from *Iron Age*, May 1, 1919.

†Excerpt from "Coal Mine Fatalities in the U. S., 1918," U. S. Bureau of Mines.

FATALITIES AT COAL MINES FOR THE YEARS ENDED DEC. 31, 1917 AND 1918.

| Cause | Number Killed. 1917 | 1918 | Increase or Decrease | Percentage of Increase or Decrease. |
|---|---|---|---|---|
| Underground: | | | | |
| Falls of roof or face | 1,218 | 1,293 | +75 | +5.16 |
| Mine cars and locomotives | 482 | 506 | +24 | +4.98 |
| Gas and dust explosions | 362 | 129 | —233 | —64.36 |
| Explosives | 111 | 135 | +24 | +21.62 |
| Electricity | 79 | 88 | +9 | +11.39 |
| Miscellaneous underground | 127 | 129 | +2 | +1.57 |
| Totals underground | 2,379 | 2,280 | —99 | —4.16 |
| Shaft: | | | | |
| Totals shaft | 52 | 52 | ..... | ..... |
| Surface: | | | | |
| Haulage | 114 | 118 | +4 | +3.51 |
| Machinery | 51 | 47 | —4 | —7.84 |
| Miscellaneous | 100 | 82 | —18 | —18.00 |
| Totals surface | 265 | 247 | —18 | —6.79 |
| Grand totals | 2,696 | 2,579 | —117 | —4.34 |

The general reduction shown is still more gratifying on account of the 6% increase in production. The amount of coal produced in 1918 is estimated at 685,300,000 tons, as compared with 651,402,374 tons in 1917. The production per fatality in 1918 was the largest on record, being 266,000 tons, as compared with 241,600 in 1917.

The days worked in 1915 were 209; in 1916, 235; in 1917, 251; whereas in 1918 the increased production was brought about by working more days, rather than by a larger number of men employed. The estimates by inspectors show about 760,000 men were employed, compared with 757,317 in 1917.

In 1918 there were only three mine explosions, and there was one mine fire, in each of which more than five men were killed, representing a total of 54 fatalities, as compared with 7 similar disasters in 1917, resulting in 251 fatalities, thus indicating a considerable advance in the use of safety devices and appliances for the prevention of mine explosions.

## Metal Imports and Exports of Japan

The following figures of the specified metals imported into Japan during 1917 and 1918 are given in a recent issue of the *Ironmonger*:

| Metal | 1917 (Metric Tons) | 1918 (Metric Tons) |
|---|---|---|
| Lead (pig) | 15,639 | 35,841 |
| Imported from: | | |
| China | 582 | 351 |
| United States | 2,620 | 13,444 |
| Australia | 11,911 | 20,501 |
| Other countries | 526 | 1,545 |
| Tin (pig) | 2,010 | 2,830 |
| Imported from: | | |
| China | 228 | 586 |
| Straits Settlements | 1,548 | 1,676 |
| Other countries | 234 | 568 |

Exports from Japan were as follows:

| Metal | 1917 (Metric Tons) | 1918 (Metric Tons) |
|---|---|---|
| Zinc slabs | 36,541 | 16,847 |
| Copper ingots, etc | 71,613 | 31,809 |
| Copper plates and sheets | 966 | 1,466 |
| Copper wire | 3,455 | 3,400 |
| Brass and yellow metal plates and sheets | 12,166 | 4,613 |
| Brass and yellow metal bars and rods | 3,325 | 758 |

In 1917, the United Kingdom received 24,784 tons of the copper exported from Japan, France took 18,121 tons, and Asiatic Russia, 10,852 tons, the remainder going to China, British India, the United States, and

other countries. In 1917, exports to France were 8578 tons, to the United Kingdom, 5454, and to Asiatic Russia, 140 tons.

Exports of zinc from Japan in 1918 went to the following countries, the 1917 figures being given in parentheses: United Kingdom, 4165 tons (18,952); France, 7055 (5928); British India, 3505 (2007); other countries, 2122 tons (9754).

## The Banca Tin Trade

Banca tin comes exclusively from the Island of Banca. The mines have been worked since about 1710, and were first operated by the natives, says a consular report. The rajahs of Palembang originally owned the island and supplied the old East India Co. with tin. The Chinese, however, first placed the mines on a firm footing, and under their direction the production of the metal increased steadily until toward the end of the century, when adverse circumstances caused a serious decrease in the output.

According to local government statistics, the total production from 1718 to 1813 amounted to approximately 70,000 tons, and from 1813 to 1820 to 8400 tons. After 1820 the government placed the industry under European management, although it still remained a Chinese industry. Since 1852 the working of the mines has been entirely supervised by European mining engineers. During the last few years the tin has been subjected to a chemical test before being exported.

Banca has an area of about 4700 square miles, and its greatest length is 115 miles. Most of the mines are situated on the north and east coasts. The ore is worked almost exclusively in open pits, which are in the alluvial deposits of many rivers and in the alluvial strata on the slopes of the small hills.

Before the war the entire production of the Banca tin mines was turned over to the Netherlands Trading Co. on a consignment basis. This company placed the tin at auction in Amsterdam, to be sold for the account of the Netherlands India government. The war, however, necessitated a different method of sale, and the tin market was removed from Amsterdam to Batavia. Now the sale is entirely in the hands of the government. The market quotations are fixed in connection with the tin quotations of London and Singapore.

During 1918, especially during the second half of the year, the tin trade had to contend with many difficulties. The monthly quotations for the year, as given below, indicate the great variations in the prices (given in florins of 40.2c.) obtained per picul (136 pounds):

PRICE OF BANCA TIN, 1918.

| Month | Price, Florins. | Month | Price, Florins. | Month | Price, Florins. |
|---|---|---|---|---|---|
| January | 178-182 | May | 212-230 | September | 222-224 |
| February | 180-220 | June | 202-214 | October | 221-222 |
| March | 196-212 | July | 206-237 | November | 180-219 |
| April | 207-208 | August | 230-246 | December | 170 |

In March, 1918, the government prohibited the exportation of tin, but this prohibition existed only for a short time. The measure, however, immediately influenced business. Prices steadily increased, except for June and July fluctuations, and in August the highest price was reached, owing probably to the influence of the rise in prices as Singapore. This rise, moreover, induced the government to fix its limit at 264.50 florins ($106.33), which was not maintained. After August the prices went steadily lower, probably because the purchase of tin in America had been turned over to one purchasing agency, and also because in Singapore the maximum price was fixed at $148 Straits currency ($84 U. S. currency). There was comparatively little buying for the last three months of the year, Japan and Hongkong being the leading purchasers. The price, notwithstanding government control, continued to go lower, and at the end of 1918 the government's limit was lowered to about 150 florins ($60.30), at which price only Hongkong was in the market.

The United States has been for the last three years by far the largest buyer of Banca tin, as illustrated by the following: The total export in 1916 was 19,740 metric tons, of which the United States took 11,689 tons, or 59%; in 1917, the total export was 15,605 tons, the United States taking 13,575 tons, or 87%; and in 1918, of a total export of 11,566 tons, America purchased 7739, or 67%, of the total. The total production for 1918 was about 14,000 tons. The total exports to all countries for the years 1916, 1917, and 1918 were as follows:

EXPORTS OF BANCA TIN

| Countries. | 1916, Metric Tons | 1917, Metric Tons | 1918, Metric Tons | Countries. | 1916, Metric Tons | 1917, Metric Tons | 1918, Metric Tons |
|---|---|---|---|---|---|---|---|
| France | 1,776 | ..... | 532 | United States | 11,689 | 13,575 | 7,739 |
| Great Britain | 3,159 | ..... | ..... | All other countries | 534 | 1 | 1316 |
| Japan | 820 | 1,164 | 1,624 | | | | |
| Straits Settlements | 1,762 | 865 | 355 | Totals | 19,740 | 15,605 | 11,566 |

## Advocates Exploration Work for Returned Soldiers

Members of the Canadian Mining Institute are being urged by H. Mortimer-Lamb, secretary-treasurer of that organization, to support representations which have been made to Sir James Lougheed, Minister of Soldiers' Civil Reëstablishment, asking for the organization of a prospecting expedition headed by returned men, to explore and investigate the mining possibilities of those parts of the dominion of which little is known.

The suggestion is that the government should utilize returned soldiers in the work of searching for minerals, under the auspices and direction of the Department of Mines. It is recommended that suitable territory should be selected in different parts of Canada and that each section so chosen and defined be placed in charge of an officer of the department, whose duty is would be to act as general supervisor of the work of the exploration parties. Each of the parties would be under a mining engineer who is a returned soldier, and the personnel of each expedition would be made up of returned men who are qualified for the work of prospectors.

**The Annual Report of the Judge Mining and Smelting Co., Park City, Utah, shows four dividends of 12½c. each, making a total of $240,000 paid during 1918. There was sold 19,176 tons of ore; 40,622 tons mill ore was treated, producing 6700 tons lead concentrates and 4580 tons zinc concentrates. The ratio of concentration for combined lead and zinc concentrates was 3.60 to 1. Receipts from all sources were $1,090,342; expenditures were $1,152,001, including dividends. There was a decrease of $61,659 in cash surplus. Against this, 1,602,000 lb. high-grade spelter and approximately 1000 tons zinc concentrates and 1200 tons residues were on hand or in transit to market at close of the year. The zinc plant is producing high-grade spelter, and, though a few improvements are still necessary, continual increase in production is expected. The average daily capacity of the mill is 404 tons.**

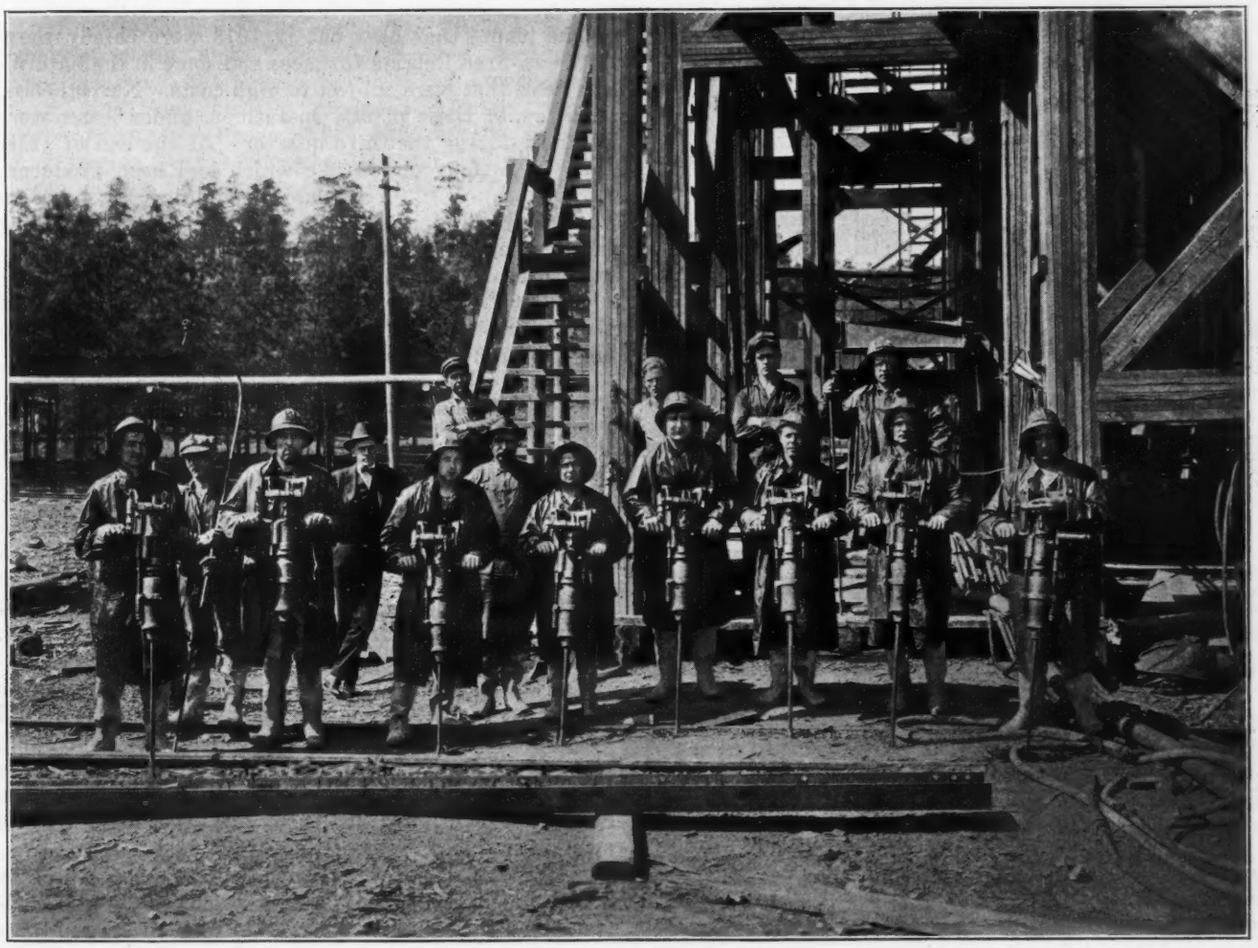
# Photographs From the Field

THE 250-TON CONCENTRATOR OF THE IDAHO CONTINENTAL CO. AT KLOCKMANN, IDAHO

PLANT OF MONTANA-IDAHO COPPER CO. AT ADAIR, IDAHO

THE PYNE SHAFT AT BESSEMER, ALA., THE FIRST VERTICAL SHAFT IN THE BIRMINGHAM DISTRICT

The No. 4, or Pyne, shaft of the Woodward Iron Co. is being sunk by the E. J. Longyear Co., of Minneapolis, Minn. Work was begun Aug. 11, 1918. The shaft is 13 x 21 ft. in section and is to be 1300 ft. deep. Fabricated steel sets are being put in, and it is to be lined with concrete. In addition to the shaft sinking, much development work is to be done by the contractors.



SINKING CREW AT NEW VERTICAL SHAFT OF THE WOODWARD IRON CO., BESSEMER, ALABAMA

# Spelter Statistics for 1918

BY W. R. INGALLS

REVISED and complete statistics of the zinc industry of the United States in 1918 are given in this article, reports having been received from all of the ore smelters. I did not undertake to collect the statistics of production by the dross smelters either in 1917 or 1918, and the total of spelter production reported as available for consumption is short by just so much.

In a statistical investigation of this subject it is difficult to draw the line between spelter recovered *after use* and spelter reworked from waste *in the course of manufacture.* The former is a true addition to the supply available for consumption; the latter is merely an incident to consumption. About all that may safely be said statistically on this subject is that there is a rather large production of reclaimed spelter and that statistics of consumption which do not take it into account are incomplete.

As usual, the statistics for the previous year have beer revised in making the present compilation. However, this statistical investigation has been continued for so many years, and is now so well organized, that there is but little occasion for revision.

*Production*—The total production of spelter by ore smelters in 1918 was 525,350 tons, against 682,411 tons in 1917. In 1918 there were 14 ore smelters who produced spelter from dross to a more or less extent, a decrease of three below the previous year. The production from dross, skimmings, etc., was 13,157 tons in 1918, against 16,166 tons in 1917.

SPELTER PRODUCTION, 1913-1918, BY QUARTERS

(In Tons of 2000 Lb.)

Reports of Ore Smelters Only

| | I | II | III | IV |
|---|---|---|---|---|
| **1913** | | | | |
| Illinois | 27,924 | 28,523 | 26,118 | 28,986 |
| Kansas-Missouri | 22,006 | 23,820 | 19,204 | 20,127 |
| Oklahoma | 21,430 | 21,840 | 18,502 | 21,458 |
| Others (a) | 20,722 | 20,153 | 19,238 | 18,211 |
| Totals | 92,082 | 94,336 | 83,062 | 88,782 |
| **1914** | | | | |
| Illinois | 31,005 | 32,482 | 32,512 | 34,588 |
| Kansas-Missouri | 13,939 | 14,659 | 13,193 | 11,633 |
| Oklahoma | 22,563 | 22,960 | 22,945 | 23,999 |
| Others (a) | 22,717 | 22,715 | 24,106 | 24,296 |
| Totals | 90,224 | 92,816 | 92,756 | 94,516 |
| **1915** | | | | |
| Illinois | 35,786 | 39,511 | 41,791 | 44,577 |
| Kansas-Missouri | 14,090 | 24,554 | 32,152 | 40,256 |
| Oklahoma | 24,713 | 26,984 | 28,613 | 31,095 |
| Others (a) | 26,255 | 30,575 | 31,360 | 34,830 |
| Totals | 100,844 | 121,624 | 133,916 | 150,758 |
| **1916** | | | | |
| Illinois | 43,344 | 45,547 | 41,953 | 48,651 |
| Arkansas | ..... | ..... | 2,977 | 4,660 |
| Kansas-Missouri | 38,513 | 42,488 | 39,447 | 33,948 |
| Oklahoma | 34,994 | 38,786 | 42,604 | 52,680 |
| Others (a) | 37,853 | 39,873 | 41,514 | 48,186 |
| Totals | 156,704 | 166,694 | 168,495 | 188,125 |
| **1917** | | | | |
| Illinois | 48,756 | 47,237 | 40,379 | 39,699 |
| Arkansas | 5,597 | 6,847 | 7,596 | 5,661 |
| Kansas-Missouri | 26,350 | 25,621 | 19,443 | 15,091 |
| Oklahoma | 53,280 | 57,227 | 48,478 | 45,602 |
| Electrolytic | 7,950 | 8,362 | 5,096 | 5,837 |
| Others (a) | 42,013 | 41,700 | 39,736 | 38,853 |
| Totals | 183,946 | 186,994 | 160,728 | 150,743 |
| **1918** | | | | |
| Illinois | 34,848 | 34,829 | 36,445 | 35,686 |
| Arkansas | 6,156 | 5,603 | 7,618 | 7,373 |
| Kansas-Missouri | 10,284 | 5,016 | 7,198 | 9,336 |
| Oklahoma | 37,751 | 35,261 | 35,036 | 35,323 |
| Electrolytic | 8,094 | 9,407 | 11,049 | 10,335 |
| Others (a) | 36,881 | 36,265 | 35,481 | 34,075 |
| Totals | 134,014 | 126,381 | 132,827 | 132,128 |

(a) With the exception of one plant in Colorado, these are all Eastern works In the fourth quarter of 1915 and in 1916 is included Anaconda and other electrolytic production.

Toward the end of the first quarter of 1918, the low price for spelter and the unpromising outlook caused the discontinuance of smelting in four plants, and some of these were abandoned, including among them the famous old Glendale plant of the Edgar Zinc Co., at Carondelet, St. Louis, which was one of the historic smelteries of the United States, it having been in operation for about 50 years. This cessation of production led to a considerable contraction in the figure for the second quarter, but with a temporary revival in the market during the summer, more furnaces were put in operation, and the production in the third quarter was about as large as that in the first. In the fourth quarter, in spite of the armistice and the unmistakable approach of adverse conditions, production was maintained at undiminished rate.

PRODUCTION OF SPELTER

(In Tons of 2000 Lb.)

By Ore Smelters Only

| | 1914 | 1915 | 1916 | 1917 | 1918 |
|---|---|---|---|---|---|
| Arkansas | ..... | ..... | 7,637 | 25,701 | 26,750 |
| Colorado | 8,152 | 8,984 | 8,908 | 7,735 | 3,897 |
| Illinois | 130,587 | 161,665 | 181,495 | 176,071 | 141,808 |
| Missouri-Kansas | 53,424 | 111,052 | 154,396 | 86,505 | 31,834 |
| Oklahoma | 92,467 | 111,405 | 169,064 | 204,587 | 143,371 |
| Electrolytic | ..... | ..... | 10,963 | 27,245 | 38,885 |
| East and others (a) | 85,682 | 114,036 | 147,555 | 154,567 | 138,805 |
| Totals | 370,312 | 507,142 | 680,018 | 682,411 | 525,350 |

(a) Includes Anaconda and other electrolytic production in 1915.

The plants that blew out in 1918 were chiefly those with coal-fired Belgian furnaces and some in the natural-gas fields that were subject to high costs. Nevertheless, in a few of these plants, operations, under lease, were resumed during the third quarter. At the end of 1918, there were four plants idle which had been producers early in the year. The plants remaining in operation were mainly those of the stronger companies, and their managements exhibited a disposition to continue operations regardless of the depressed market conditions.

*Spelter Production According to Fuel.*—The output of the ore smelters using coal as fuel, and the proportion of their production with respect to the whole, follow:

SPELTER PRODUCTION ACCORDING TO FUEL

| Year | Production, Tons | Per Cent. of Total | Year | Production, Tons | Per Cent. of Total |
|---|---|---|---|---|---|
| 1911 | 119,989 | 40 | 1915 | 227,143 | 45 |
| 1912 | 134,077 | 38 | 1916 | 289,007 | 42 |
| 1913 | 157,653 | 44 | 1917 | 282,498 | 41 |
| 1914 | 173,520 | 48 | 1918 | 239,386 | 45 |

The remainder of the production was made by smelters using natural gas as fuel. Up to 1915 there was a general tendency toward increasing production by the smelters using coal as fuel, their proportion of the total output having risen from 40% in 1911, to 48% in 1914. In 1915 it fell to 45%, in spite of the revival of smelting at Pittsburg, Kan., which is easily explained. There were a lot of inactive natural-gas smelteries that could be put quickly into operation, which was done, and, moreover, it was quicker and easier to build new plants in the natural-gas fields than in the coal fields. The same conditions continued in 1916, and the ratio of the spelter produced by smelting with coal fell to 42%, which took us about back to the situation of 1912. In 1918, the percentage of spelter produced by the coal-fired plants rose again, this reflecting the discontinuance of smelting by the more ephemeral plants in the

gas fields and the reconcentration of smelting among the more permanent plants of the coal fields.

*Electrolytic Zinc*—The production of electrolytic zinc in the United States in 1918 was 38,885 tons, against 27,245 tons in 1917. The Consolidated Mining and Smelting Co., of Canada, at Trail, B. C., produced 12,574 tons in 1918 and 9956 tons in 1917. The American producers in 1918 were the Anaconda, River Smelting and Refining Co., Judge Mining and Smelting Co., and the Mammoth plant of the United States Smelting, Refining and Mining Company.

One concern that was engaged in the electrolytic refining of crude spelter, whose output does not appear in these statistics, for the reason that it duplicates the report of distilled spelter, ceased operations in 1918, and its plant was abandoned.

The Electrolytic Zinc Co., of Australasia, which has built a plant at Risdon, near Hobart, Tasmania, for the treatment of Broken Hill ore, began production early in 1918, and since then produced at the rate of about 10 tons of spelter per day. This plant is considered to promise commercial success, and plans are being made for a large extension of it. Outside of the United States, Canada, Tasmania, and Japan, there was no noteworthy production of electrolytic spelter in 1918, but new plants were projected in various parts of the world.

*Fine Zinc*—It was reported from 11 works in 1918 that they had been engaged in the redistillation of common spelter. The aggregate production of refined spelter reported by them was 43,386 tons. This was spelter of high grade, probably assaying in the main from 99.75 to 99.90% of zinc. The production of redistilled spelter in 1917 was 41,468 tons. Among other fine spelters is the Mascot brand of the American Zinc, Lead and Smelting Co., produced directly from ore. Spelters running above 99.9% zinc are the Horsehead and Bertha brands, directly distilled; and the electrolytic metal. Altogether, the output of fine zincs in 1918 was upward of 125,000 tons. The exact figure may not be stated, for it would lead to the disclosure of individual business.

In view of the conditions that existed in the market for high-grade zinc, it is rather surprising that the production, especially of redistilled zinc, was so large as the statistics show. The explanation is manifestly that during the major part of the year, and, indeed, right up to the armistice, the governments were very large buyers of this grade of zinc, and the modification of the ordnance specifications in the early part of the year furnished a larger outlet for the redistillers. As things turned out, all of the governments over-bought their requirements, and at the end of 1918 found themselves with large stocks of high-grade zinc on hand. Previous to that time, the margin between the prices for high-grade and common zinc had so contracted that there was no longer any profit in redistilling, and the refining of spelter in that way was discontinued and is not likely to be resumed again.

*General Conditions of Ore Supply*—The reports as to ore receipts give interesting indications as to practice in smelting and as to market conditions. The smelters who make sulphuric acid continue, as in the past, to draw their ore mainly from Wisconsin and from the Joplin district (including Oklahoma). For the manufacture of sulphuric acid this ore is recognized to be superior, but it is noteworthy that several of the zinc acid makers are using a larger and larger proportion of Western ore. Of the total number of works—36—there were 13 in 1918 that used nothing but ore from the high-grade districts, viz., Missouri, Kansas, Oklahoma, Wisconsin, and Arkansas, the total quantity taken by them from those states being 297,652 tons. There were three works that did not use any ore from the high-grade districts, their chief supply being ore from the Rocky Mountain region and from foreign countries. Imported ores were smelted by 14 works. In 1918 Australian ore was received at one smeltery east of the Mississippi River.

In the case of every zinc-ore producing state, there was decreased production in 1918, except in Tennessee and the Joplin district. With respect to the latter, the reports by the smelters do not permit a separation according to the portions of what is commonly considered the Joplin district. However, it is well known that the output of the mines in the immediate vicinity of Joplin decreased, while there was a tremendous increase in the output of Oklahoma, especially of the Miami district of that state. The mines of that district, which possess large orebodies of relatively high grade, have become one of the controlling factors in the American zinc industry. The high grade of the ore permits it to be produced and sold at prices not very different from pre-war prices.

*Ore Smelted*—The smelters, as distinct and separate from the electrolytic producers, reported that in 1918 they treated 888,693 tons of blende and 256,857 tons of calamine, a total of 1,145,550 tons. In 1917 they smelted 1,149,172 tons of blende and 424,311 tons of calamine, a total of 1,573,483 tons. As I remarked last year, it should not be attempted to draw too fine distinctions from these figures respecting either the quantity or the average yield of the ore smelted, some smelters apparently having reported "ore received" as "ore smelted," and there was probably some other confusion respecting this inquiry. However, we may draw some rough deductions.

ORE SMELTED AND YIELD

| | 1915 | 1916 | 1917 | 1918 |
|---|---|---|---|---|
| Total production of spelter, tons... | 507,142 | 680,018 | 682,411 | 525,350 |
| Ninety per cent. of production of zinc dust..... | 1,299 | 2,086 | 4,424 | 5,580 |
| Total production of zinc, tons.... | 508,441 | 682,104 | 686,835 | 530,930 |
| Less production of electrolytic, tons ..... | | 10,963 | 27,245 | 38,885 |
| | 508,441 | 671,141 | 659,590 | 492,045 |
| Less production from dross, tons... | 12,538 | 11,681 | 16,166 | 13,157 |
| Net production of spelter, tons... | 495,903 | 659,460 | 643,424 | 478,888 |
| Amount of ore smelted, tons..... | 1,188,075 | 1,713,912 | 1,573,483 | 1,145,550 |
| Average spelter per ton ore, per cent. | 41.74 | 38.49 | 40.88 | 41.80 |
| Estimated average recovery, per cent..... | 83.3 | 83.3 | 82.0 | 82.0 |
| Estimated grade of ore, per cent... | 50.1 | 46.2 | 49.9 | 51.0 |

In 1914 the calamine smelted was about 26½% of the total; in 1915 it was about 28½%; in 1916 about 29¾%; in 1917, about 26.9%; and in 1918, about 22.4%. The tendency to use a larger proportion of calamine in smelting that was exhibited in 1915 and 1916 was checked in 1917, when the smelters were forced by adverse market conditions to seek high-grade blende rather than low-grade calamine, and in 1918 the relative use of calamine diminished further.

*Grade of Ore Smelted*—In the accompanying table an attempt has been made to estimate the average grade of the ore smelted during the last few years. The most uncertain factor is the percentage of metallurgical extraction, which has been assumed at 82% in 1918; 82% in 1917; 83.3% in 1915-16; and at 86% in 1914. These

assumptions are purely arbitrary. Of course, the calculated grade of the ore is too low in just the proportion that the estimate of metallurgical recovery is too high. However, the figures afford a sort of an index as to the nature of the raw material purchased by the smelters.

*Receipts of Ore*—The receipts of ore by smelters in 1918 showed a decrease, the grand total having been 1,166,097 tons, compared with 1,613,272 tons in 1917. These totals include the receipts of ore by the smelters only, and do not include the ore that was taken by the manufacturers of zinc oxide or what was used by the producers of electrolytic zinc. The statistics show 1,145,550 tons smelted and 1,166,097 tons received.

RECEIPTS OF ZINC ORE

(In tons of 2000 lb. This table includes the receipts of ore by the smelters only and does not include the production of ore exported or what was taken by the electrolytic producers or by the manufacturers of zinc oxide.)

| State | 1913 | 1914 | 1915 | 1916 | 1917 | 1918 |
|---|---|---|---|---|---|---|
| Arizona | 9,347 | 6,357 | 14,718 | 17,243 | 14,837 | 1,962 |
| Arkansas | 1,500 | 1,737 | 7,017 | 12,854 | 20,225 | (c) |
| California | 6,796 | 8,827 | 27,445 | 41,291 | 12,444 | 5,351 |
| Colorado | 220,166 | 164,739 | 148,359 | 194,418 | 184,304 | 82,995 |
| Idaho | 31,835 | 57,001 | 78,767 | 104,575 | 86,172 | 62,109 |
| Kentucky | 441 | 434 | 1,863 | 2,460 | 2,019 | 799 |
| Missouri-Kansas | 280,000 | 247,723 | 278,099 | 369,397 | 301,809 | (c) |
| Missouri-Kansas-Oklahoma - Arkansas | (d) | (d) | (d) | (d) | (d) | 476,954 |
| Montana | 91,257 | 125,663 | 200,528 | 233,645 | 171,904 | 152,905 |
| Nevada | 22,313 | 20,447 | 24,949 | 51,670 | 35,045 | 19,733 |
| New Mexico | 14,593 | 15,369 | 37,042 | 35,734 | 16,353 | 13,206 |
| Oklahoma | 23,500 | 26,247 | 25,231 | 42,799 | 153,035 | (c) |
| Tennessee | 8,297 | 18,708 | 38,527 | 43,309 | 38,488 | 45,924 |
| Utah | 27,073 | 20,322 | 21,535 | 43,240 | 21,381 | 14,758 |
| Wisconsin (a) | 89,662 | 74,311 | 90,128 | 91,561 | 137,248 | 123,506 |
| Others and undistributed | 57,241 | 57,936 | 122,490 | 111,273 | 192,393 | 98,870 |
| Totals | 884,021 | 845,821 | 1,116,698 | 1,395,469 | 1,387,657 | 1,099,072 |
| Mexico | 19,965 | 16,414 | 49,171 | 142,687 | 135,368 | 49,532 |
| Canada | 6,012 | 10,532 | 14,000 | 31,877 | 21,502 | 14,502 |
| Australia | ..... | ..... | 68,448 | 134,464 | 37,031 | 618 |
| Other foreign | ..... | ..... | 9,211 | 73,394 | 31,714 | 2,373 |
| Grand totals (b) | 909,998(b) | 872,767 | 1,257,528 | 1,777,891 | 1,613,272 | 1,166,097 |

(a) Including Illinois and Iowa. (b) In addition to the ore reported from Canada and Mexico, zinc smelters received a few thousand tons from Europe and Eastern Siberia in 1913. (c) See "Missouri-Kansas-Oklahoma-Arkansas." (d) See under separate states.

*Spelter Stocks*—The stock of spelter at works on Dec. 31, 1918, being the aggregate of the reports of all the smelters, was 40,325 tons, compared with 60,415 tons at the beginning of 1918. These figures include both high-grade and common spelter.

Besides the stocks of spelter in the hands of the American smelters at the end of 1918, there was a large stock in the hands of the United States Government. Estimates respecting this were uncertain, but it may be assumed in the light of later information that it was probably about 50,000 tons, a very large part of which was in the form of high-grade spelter. The stocks of spelter abroad also were large. The British Ministry of Munitions on Jan. 1 reported 30,290 long tons in its possession. On Apr. 1, its reports showed 38,050 long tons, the increase reflecting the delivery into Great Britain of stocks of the Munition Ministry, previously held elsewhere. The French government at the end of 1918 had about 45,000 tons. Italy was known to have a large stock, and there were known to be large stocks in Japan and Germany. There was no doubt whatever as to the stocks of spelter throughout the world being of great magnitude in the aggregate.

*Sulphuric Acid*—In 1918, there were 11 smelters who produced sulphuric acid from blende, one less than in 1917. The enumeration is, however, open to some criticism, owing to complications that are developing in the industry. It is often good business to roast the blende at a good center for the distribution for sulphuric acid, and reship the roasted ore to a good point for zinc distillation. The Western Chemical Co. has for a long time roasted ore at Denver, Colo., and sold the product to smelters. The National Zinc Co. has no roasting furnaces at its smeltery at Springfield, Ill., which gets its ore from the roasting plant of the company at Argentine, Kan. Similarly, the Grasselli Chemical Co. roasts at Canton, Cincinnati, Newcastle, Cleveland, and Grasselli the ore that is needed by its smelteries at Clarksburg, Meadowbrook, and Terre Haute. The New Jersey Zinc Co. has a roasting plant at Tiltonville, Ohio, which supplies other smelters. With the movement of the zinc-smelting industry to the eastward, the separation of blende roasting and zinc distillation is becoming more marked, as it has been for a long time in Europe. It will appear from this that the definition between zinc smelters' acid and acid derived from other sources is becoming more and more uncertain. The statistics that I offer are to be regarded, therefore, as more valuable for comparative purposes than as indicative of precise results, although in the latter respect they are probably not far out of the way.

STATISTICS OF SPELTER-SULPHURIC ACID WORKS

(In Tons of 2000 Lb.)

| | 1914 | 1915 | 1916 | 1917 | 1918 |
|---|---|---|---|---|---|
| Ore received | 434,666 | 614,565 | 752,021 | 779,941 | 485,276 |
| Spelter produced | 196,529 | 244,252 | 293,525 | 313,433 | 217,134 |
| Sulphuric acid, basis 60 deg. | 355,424 | 475,740 | 683,514 | 817,573 | 636,149 |

It is to be remarked that no attempt should be made to determine from the accompanying statistics any ratios between ore received and sulphuric acid produced or between spelter produced and sulphuric acid produced, for the reason that certain concerns received and smelted a good deal of calamine, which, of course, never went through the blende-roasting department at all. Moreover, in recent years zinc smelters have been boosting their sulphurous gas by burning brimstone in the flues leading to the Glover towers. In 1918, zinc smelters reported the use of 29,408 tons of brimstone for this purpose.

*Imports and Exports*—The imports and exports of ore, spelter, sheet zinc, and zinc dust are given in an accompanying table, the figures of which require no explanation. It will be observed that the Government figures for the exportation of spelter are different from those representing the production of spelter in bond reported by the smelters; also that there are discrepancies with respect to the importation of ore. These differences are explained in part by the difference of the periods comprised within the respective reports, the smelters reporting the spelter when it leaves their works and the Government reporting it when it is entered for export in the custom house. In 1918 the smelters reported the production of 18,610 tons of spelter in bond, of which 15,157 tons was exported, while the Government reported the exportation of 19,855 tons of foreign origin.

In addition to the figures given in the tables which accompany this article, the following data are of interest: The zinc content of ore imported in 1918 was 24,809 short tons, whereas in 1917 it was 72,474 short tons. In 1918 the United States exported 15,816 tons of zinc dross, compared with 13,302 tons in 1917.

The table of imports and exports for 1916 has been revised to agree with the latest figures of the U. S. Department of Commerce. Changes were made in the cases of ore imports and of exports of spelter and sheet zinc.

*Smelting Capacity*—The capacity of the zinc-smelting works of the United States at the end of 1918 is

given in the accompanying table. This statement falls short of measuring the real increase of zinc-producing capacity, for it takes no account of the electrolytic plants.

IMPORTS AND EXPORTS, BY QUARTERS

| Imports | Ore, Long Tons | Spelter, Lb. | Zinc Dust, Lb. |
|---|---|---|---|
| **1914** | | | |
| I | 3,355 | 500,253 | 1,288,249 |
| II | 4,727 | 512,123 | 1,256,259 |
| III | 6,849 | 664,012 | 535,471 |
| IV | 13,607 | 83,191 | 1,524,128 |
| Year | 28,538 | 1,759,579 | 4,604,107 |
| **Exports** | **Ore, Long Tons (c)** | **Spelter, Lb. (a)** | **Dross, Lb.** |
| I | 2,883 | 842,465 | 572,477 |
| II | 4,297 | 872,511 | ..... |
| III | 1,319 | 48,177,681 | 1,239,570 |
| IV | 1,421 | 90,591,936 | 3,259,020 |
| Year | 9,920 | 140,484,593 | 5,071,067 |
| **1915** | | | |
| **Imports** | **Ore, Long Tons** | **Spelter, Lb** | **Zinc Dust, Lb** |
| I | 14,909 | 480,949 | 502,008 |
| II | 44,449 | 496,601 | 316,073 |
| III | 33,863 | 461,957 | 355,431 |
| IV | 48,611 | 369,457 | 538,861 |
| Year | 141,832 | 1,808,964 | 1,712,373 |
| **Exports** | **Ore, Long Tons (c)** | **Spelter, Lb.** | **Zinc Sheet, Lb.** |
| I | ... | 83,313,386 (a) | (e) |
| II | 605 | 56,829,272 (a) | (e) |
| III | 108 | 39,528,063 (b) | 12,929,438 |
| IV | 30 | 58,318,807 (b) | 11,836,786 |
| Year | 743 | 237,989,528 | 24,766,224 |
| **1916** | | | |
| **Imports** | **Ore, Long Tons** | **Spelter, Lb.** | **Zinc Dust, Lb** |
| I | 110,293 | 435,896 | 779,253 |
| II | 98,497 | 492,823 | 477,425 |
| III | 74,855 | 243,186 | 273,899 |
| IV | 60,966 | 196,655 | 337,125 |
| Year | 344,611 | 1,368,560 | 1,867,702 |
| **Exports** | **Ore, Long Tons** | **Spelter, Lb. (b)** | **Zinc Sheet, Lb.** |
| I | ..... | 66,840,110 | 7,174,116 |
| II | 30 | 78,645,760 | 3,748,914 |
| III | 40 | 113,997,791 | 6,399,813 |
| IV | ..... | 128,219,039 | 7,701,339 |
| Year | 70 | 387,702,700 | 25,024,182 |
| **1917** | | | |
| **Imports** | **Ore, Long Tons** | **Spelter, Lb.** | **Zinc Dust, Lb.** |
| I | 65,087 | 153,127 | 112,199 |
| II | 61,859 | 119,005 | 304,638 |
| III | 39,392 | 99,868 | 228,510 |
| IV | 22,587 | 141,153 | 155,990 |
| Year | 188,925 | 513,153 | 801,337 |
| **Exports** | **Ore, Long Tons** | **Spelter, Lb.** | **Zinc Sheet, Lb.** |
| I | ..... | 124,254,565 | 3,843,800 |
| II | 32 | 109,257,705 | 11,525,971 |
| III | 334 | 92,458,525 | 10,625,019 |
| IV | 814 | 77,948,988 | 7,053,201 |
| Year | 1,180 | 403,919,783 | 33,047,991 |
| **1918** | | | |
| **Imports** | **Ore, Long Tons** | **Spelter, Lb.** | **Zinc Dust, Lb.** |
| I | 23,490 | 43,166 | 11,846 |
| II | 16,765 | 19,318 | 11,200 |
| III | 11,199 | 7,762 | ..... |
| IV | 11,851 | 306 | ..... |
| Year | 63,305 | 70,552 | 23,046 |
| **Exports** | **Ore, Long Tons** | **Spelter, Lb.** | **Zinc Sheet, Lb.** |
| I | 55 | 51,121,474 | 4,741,022 |
| II | ..... | 41,850,252 | 6,690,594 |
| III | ..... | 31,842,295 | 5,900,429 |
| IV | ..... | 47,382,576 | 10,483,892 |
| (a) Year | 55 | (d) 172,446,400 | (d) 27,750,910 |

(a) Includes zinc in sheets. (b) Does not include zinc in sheets, which was reported separately from July 1, 1915. (c) In addition to the exports of ore here reported, there were exported ore and calamine of foreign origin, the zinc content of which amounted to 279,000 lb. in 1914 and 1,218,500 lb. in 1915. (d) The quarterly figures do not foot up to the total given. Both are from the report of the U. S. Dept. of Commerce, and the difference is probably due to corrections made after the monthly figures were published, of which we have no knowledge. (e) Included with spelter.

At the end of 1918 the listed smelters of the United States possessed a total of about 189,000 retorts, of which operating smelters had 176,392. Of these the number in use on Dec. 15 was 124,068.

No new furnaces were reported as being in process of construction at the end of 1918.

*Market Conditions*—At the beginning of 1918 common spelter was quoted at 7⅝c. St. Louis. There was an over-production and stocks were accumulating. The statistical conditions caused a decline in the market to 6.60c. That relatively low price, which was estimated to be equivalent to about 3½c. before the war, caused a general closing of inefficient smelteries. Many of these were abandoned, and not a few were dismantled.

ZINC-SMELTING CAPACITY OF THE UNITED STATES

(Number of Retorts at End of Years)

| Name | Situation | 1917 | 1918 |
|---|---|---|---|
| American Spelter Co. (a) | Pittsburg, Kan. | 896 | (d) 896 |
| American Steel & Wire Co. | Donora, Penn. | 9,120 | 9,120 |
| American Zinc and Chem. Co. (a) | Langeloth, Penn. | 7,296 | 7,296 |
| American Zinc Co. of Ill. | Hillsboro, Ill | 4,864 | 4,864 |
| American Zinc, Lead and Smg. Co. (a) | Dearing, Kan | 4,480 | (e) .... |
| American Zinc, Lead and Smg. Co. (a) | Caney, Kan.. | 6,080 | (f) 6,080 |
| American Zinc, Lead and Smg. Co. (a) | Neodesha, Kan. | 3,760 | (e) .... |
| American Zinc, Lead and Smg. Co. | E. St. Louis, Ill. | 5,620 | 5,620 |
| Arkansas Zinc and Smelting Corpn. | Van Buren, Ark. | 3,200 | 3,200 |
| Athletic Min. and Smelting Co. | Fort Smith, Ark. | 1,664 | 2,496 |
| Bartlesville Zinc Co. | Bartlesville, Okla. | 5,184 | 7,488 |
| Bartlesville Zinc Co. | Blackwell, Okla. | 9,600 | 9,600 |
| Bartlesville Zinc Co. | Collinsville, Okla. | 13,400 | (e) .... |
| Bartlesville Zinc Co., Lanyon-Starr. | Bartlesville, Okla. | 3,456 | 3,456 |
| Collinsville Zinc Co. (a) | Collinsville, Ill. | 1,984 | (d) 1,984 |
| Eagle-Picher Lead Co. | Henryetta, Okla. | 3,000 | 4,000 |
| Edgar Zinc Co. | Carondelet, Mo. | 1,982 | (e) .... |
| Edgar Zinc Co. | Cherryvale, Kan. | 5,040 | 5,040 |
| Fort Smith Spelter Co. | Fort Smith, Ark. | 2,560 | 2,560 |
| Grasselli Chemical Co. | Clarksburg, W. Va. | 5,760 | 5,760 |
| Grasselli Chemical Co. | Meadowbrook, W. Va. | 8,520 | 8,520 |
| Grasselli Chemical Co. | Terre Haute, Ind. | 3,360 | 4,200 |
| Hegeler Zinc Co. | Danville, Ill. | 5,400 | 5,400 |
| Henryetta Spelter Co. | Henryetta, Okla. | (a) 3,000 | (b) 3,000 |
| Illinois Zinc Co. | Peru, Ill | (b) 4,640 | 5,440 |
| J. B. Kirk Gas and Acid Co. (a) | Iola, Kan. | 3,440 | (b) 3,440 |
| Kusa Spelter Co. | Kusa, Okla. | 7,520 | 5,360 |
| Lanyon Smelting Co. | Pittsburg, Kan. | (d) 448 | (d) 448 |
| Robert Lanyon Zinc and Acid Co. | Hillsboro, Ill. | 3,200 | 3,200 |
| Matthiessen & Hegeler Zinc Co. | La Salle, Ill. | 6,168 | 6,168 |
| Mineral Point Zinc Co. | Depue, Ill. | 9,068 | 9,068 |
| National Zinc Co. | Bartlesville, Okla | 4,256 | 4,160 |
| National Zinc Co. | Springfield, Ill. | 4,480 | 4,480 |
| New Jersey Zinc Co. of Penn. | Palmerton, Penn. | 7,200 | 7,200 |
| Oklahoma Spelter Co. | Kuska, Okla. | (d) 1,600 | (d) 1,600 |
| Owen Spelter Co. | Caney, Kan. | 1,920 | (d) 1,920 |
| Pittsburg Zinc Co. | Pittsburg, Kan. | (d) 910 | (d) 910 |
| Prime Western Spelter Co. | Gas and Iola, Kan. | 4,866 | (g) 1,972 |
| Quinton Spelter Co. | Quinton, Okla. | 2,016 | 2,016 |
| Sandoval Zinc Co. | Sandoval, Ill. | 672 | 672 |
| Tulsa Fuel and Manufacturing Co. | Collinsville, Okla. | 6,232 | 6,232 |
| United States Smelting Co. (a) | Altoona, Kan. | 4,640 | (e) .... |
| United States Smelting Co. | Checotah, Okla. | 5,120 | (i) 5,120 |
| United States Zinc Co. | Henryetta, Okla. | 2,400 | 3,448 |
| United States Zinc Co. | Sand Springs, Okla. | 8,000 | 7,560 |
| United States Zinc Co. | Pueblo, Colo. | 2,200 | 2,208 |
| United Zinc Smelting Corpn. | Moundsville, W. Va. | 1,728 | 1,728 |
| United Zinc Smelting Corpn. | Clarksburg, W. Va. | 3,648 | (i) 3,648 |
| Weir Smelting Co. (h) | Weir, Kan. | (a) 448 | (d) 448 |
| Totals | | 216,046 | 189,026 |

(a) Closed during latter part of 1917. (b) No report received; entered the same as previous year. (c) Dismantled. (d) Idle all year. (f) Part. (4 blocks) leased to Weir Smelting Co. (g) The plant at Gas City was wrecked by cyclone, March, 1918. (h) Weir Smelting Co. is operating 4384 retorts of the Caney plant of American Zinc, Lead and Smelting Co. (i) Idle latter part of 1918.

The curtailment of production was overdone, in view of the continued large requirement of spelter for brass making, and the market price rallied to about 8½c. at the beginning of July. After a minor setback, further improvement in the statistical position advanced the price to 9⅜c. in September, but with this advance the margin between common and high-grade spelters

MONTHLY AVERAGE PRICE OF SPELTER

| | New York | | | St. Louis | | | London | | |
|---|---|---|---|---|---|---|---|---|---|
| Month | 1916 | 1917 | 1918 | 1916 | 1917 | 1918 | 1916 | 1917 | 1918 |
| Jan. | 16.915 | 9.619 | 7.836 | 16.745 | 9.449 | 7.661 | 89.810 | 48.329 | 54.000 |
| Feb. | 18.420 | 10.045 | 7.814 | 18.260 | 9.875 | 7.639 | 97.762 | 47.000 | 54.000 |
| Mar. | 16.846 | 10.300 | 7.461 | 16.676 | 10.130 | 7.286 | 95.048 | 47.000 | 54.000 |
| Apr. | 16.695 | 9.459 | 6.890 | 16.525 | 9.289 | 6.715 | 99.056 | 54.632 | 54.000 |
| May. | 14.276 | 9.362 | 7.314 | 14.106 | 9.192 | 7.114 | 94.217 | 54.000 | 54.000 |
| June. | 11.752 | 9.371 | 8.021 | 11.582 | 9.201 | 7.791 | 68.591 | 54.000 | 54.000 |
| July. | 8.925 | 8.643 | 8.688 | 8.755 | 8.473 | 8.338 | 50.750 | 54.000 | 54.000 |
| Aug. | 8.730 | 8.360 | 8.985 | 8.560 | 8.190 | 8.635 | 51.587 | 54.000 | 54.000 |
| Sept. | 8.990 | 8.136 | 9.442 | 8.820 | 7.966 | 9.092 | 52.095 | 54.000 | 54.000 |
| Oct. | 9.829 | 7.983 | 8.801 | 9.659 | 7.813 | 8.451 | 54.159 | 54.000 | 54.000 |
| Nov. | 11.592 | 7.847 | 8.491 | 11.422 | 7.672 | 8.141 | 56.023 | 54.000 | 54.100 |
| Dec. | 10.665 | 7.685 | 8.163 | 10.495 | 7.510 | 7.813 | 55.842 | 54.000 | 56.050 |
| Year. | 12.804 | 8.901 | 8.159 | 12.634 | 8.730 | 7.890 | 72.071 | 52.413 | 54.180 |

New York and St. Louis, cents per lb. London, pounds sterling per long ton.

contracted, and eventually it ceased to be profitable to refine by redistillation. The supply of common spelter for sale being thus increased, the market started on a slow but steady decline. The advent of the armistice did not produce in zinc just the same conditions as in copper and lead, for zinc had never been under control. However, the weakness of the market became

a little more pronounced, and 1918 closed with the quotation of 7.45 cents.

At the beginning of 1918 high-grade spelter was quoted in the neighborhood of 12½c. During the spring the War Industries Board fixed 12c. as a maximum price. A little later, an alteration in the Army specifications increased the supply of high-grade metal. The market becoming more competitive, the price declined below 12c. Toward the close of 1918 high-grade metal was sold at 9c., and at the very end of the year it is doubtful if it were properly quotable above 8½ cents.

The prices of sheet zinc and rolled plate were fixed at 15 and 14c., respectively, and those prices were maintained until the end of 1918, the supply being steadily short, because of insufficient manufacturing capacity. Owing to the large profit that those prices permitted, the producers of special grades of ore in the Joplin district claimed a participation in it and obtained a fixed price of $75 per ton, the requirements of the sheet zinc producers being prorated among those ore producers.

AVERAGE PRICE OF ZINC SHEETS
(In Cents per Pound)

| | 1916 | 1917 | 1918 | | 1916 | 1917 | 1918 | | 1916 | 1917 | 1918 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan. | 23.40 | 21.00 | 19.00 | May. | 24.00 | 19.00 | 15.00 | Sept. | 15.00 | 19.00 | 15.00 |
| Feb. | 24.50 | 21.00 | 18.00 | June. | 19.50 | 19.00 | 15.00 | Oct. | 15.20 | 19.00 | 15.00 |
| Mar. | 25.00 | 21.00 | 15.00 | July. | 15.60 | 19.00 | 15.00 | Nov. | 18.25 | 19.00 | 15.00 |
| April | 25.20 | 20.44 | 15.00 | Aug. | 15.00 | 19.00 | 15.00 | Dec. | 21.00 | 19.00 | 15.00 |

Average for the year 1916—20.14c.; 1917—19.62c.; 1918—15.58c.
Note—These are base prices for ordinary size sheets, in carload lots, f.o.b. La Salle-Peru, Ill., less 8% discount.

*Bonded Spelter*—In 1918 there was produced 18,610 tons of spelter in bond. In 1917 the production in this way was 82,530 tons; in 1916 it was 94,626 tons; in 1915, 15,781 tons; in 1914, 5630 tons, and in 1913, 5904 tons.

*Zinc Dust*—The production of commercial zinc dust in 1918 was 6201 tons, as compared with 4915 tons in 1917; 2318 in 1916; 1443 in 1915; 1042 in 1914; and 423 in 1913. In 1913 only two smelters were engaged in this manufacture, but when the outbreak of the war in 1914 cut off America's foreign supply, and the price rose from about 6c. per lb. to 15@16c., several additional smelters engaged in the manufacture of it, until there are now nine.

The importation of zinc dust was 12 short tons in 1918, compared with 401 tons in 1917; 934 tons in 1916; 856 in 1915; 2302 in 1914; and 220 in 1913. It will be observed that domestic producers now supply about all of the zinc dust that is required in this country. The price for zinc dust has declined in proportion with that for other grades of zinc. At present it is about 1.5 times the price for common spelter.

*Large Producers*—A particularly interesting feature of the zinc business in recent years has been the entry of several general metallurgical companies into this field. Inasmuch as several of these companies make public reports, their outputs in tons in 1918 and 1917 may he stated as follows, the figures for 1918 being given first and those for 1917 in parentheses immediately following: United States Steel Corporation, 41,715 (67,418); American Smelting and Refining Co., 20,619 (26,261); United States Smelting Co., 9386 (26,795).

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The Director of the Mint reveals that the 265,000,000 silver dollars which were melted under the Pittman Act were hauled across the continent from the Philadelphia mint to San Francisco in 18 special trains. The silver was shipped in bars weighing 62 lb. each. Its dispatch, and the transfer to ships at San Francisco, were accomplished without general knowledge. All the silver was sent to India.

## Manganese-Ore Mining Industry

The U. S. Tariff Commission has recently completed the assembling of information on the manganese-ore mining industry and has prepared an analysis of the competitive position of the United States in the manganese industry of the world. Among interesting facts recorded are the following:

Minor amounts of the ore are required by chemical and other industries, but 96% of the consumption is for making steel. Prior to the war, the United States produced less than 1% of its manganese requirements. The remainder was imported, mainly from India, Russia, and Brazil, in the form of ore, and from Great Britain in the form of ferromanganese. It is noted that the countries possessing the largest and richest deposits have an abundant and cheap labor supply. Under war conditions India and Russia were practically eliminated as sources of supply. The productive capacity of the world's major deposits is so much greater than the total demand for ore for steel making that if any single source is eliminated temporarily, the demand can be fully met by the remaining sources.

The industry expanded considerably in Brazil and in Cuba. The large supplies from these nearer countries, together with the increased domestic output, proved greater than even the enormously expanded needs of this country, and the United States became independent of British ferromanganese and of Indian and Russian ore. The Cuban industry was promoted by American interests and the entire production sent to the United States. The quantity imported from Cuba shows annual increases from 550 tons in the fiscal year 1915 to 67,780 tons in 1918, an amount equal to one-twelfth of America's total imports.

Domestic production of high-grade (35% or more manganese) ore, used largely for making ferromanganese, increased from 4063 tons in 1913 to about 294,000 tons in 1918. Production of low-grade (less than 35% manganese) ore, used partly for making spiegel and partly smelted direct in iron furnaces, increased from 85,588 tons in 1913 to over 1,079,000 tons in 1918. The number of shippers of high-grade ore in 1918 had increased from approximately 75 in 1917 to about 210. Manganese mining on a large scale in the United States, however, is an artificial industry. Under normal trade conditions, with a free movement of ore from foreign countries, it cannot continue except on a limited output. Domestic resources have been carefully estimated by the U. S. Geological Survey and found to be insufficient to supply domestic requirements for longer than three years at most. The domestic ore is low grade, obtainable in small lots only, and variable in character. Aside from the higher cost of domestic ore as compared with the foreign product, any large dependence on domestic supplies involves the rapid depletion of limited reserves.

The foreign resources are in some instances practically inexhaustible, high grade, and more easily mined than the domestic deposits. The average grade of imported ore is from 45 to 55% manganese, as compared with domestic "high grade" running 35 to 45%. A dominant factor in the domestic manganese industry is that most of the American mines are situated remote from the points of consumption, often at considerable distances from the railroad. Foreign manganese must eventually furnish the American supply, regardless of any temporary expedients that may lead to the continuance of domestic mining.

During the period of the war a number of mines were opened up and equipped for the purpose of providing manganese as a necessity in the war program. Many of these properties failed to return the capital invested up to the time of the signing of the armistice. As there was some justice in the claim that this investment had been undertaken for patriotic reasons, compensation from the Government has had consideration at the hands of Congress. Such compensation is now being adjusted under the War-Minerals Relief Bill, which provides for the investigation and liquidation by the Secretary of the Interior of certain financial losses sustained during the war period in four mining industries—manganese, tungsten, pyrites, and chromite.

## Conditions in Alabama Iron Industry

BIRMINGHAM CORRESPONDENCE

May 10th was a day of celebration in the Birmingham district, when practically all operations of all classes of business were suspended, that the employees might join in welcoming home the 167th Regiment of Infantry, part of the famous Rainbow Division. The blast furnaces were the only plants of the larger companies in operation that day, the mills and mines being given a full holiday in common with all other industries.

April closed with a low record of production for Alabama in the pig-iron industry, only 149,708 tons being produced, as against 182,845 for March, 185,570 for February, and 18,313 for January. The present outlook, however, is bright for a larger output in May. Some small sales are reported and inquiries are more numerous.

The most encouraging development in the iron and steel industry at present in the Birmingham district is the renewed activities of the Woodward Iron Co. Practically all of this company's plants have been closed for almost two months, but with two of its mines and one furnace now operating, and rumor of another furnace soon to be blown in, production is expected to increase generally during May. The company's labor was kept for the most part near at hand during the shutdown, and, as a result, no great loss in reorganizing crews is expected. Both mines and furnace are being operated on a ten-hour day schedule, with a reduction of about 15% in wages reported.

The Tennessee Coal, Iron and Railroad Co. has only a few furnaces now in operation, but the others, owing to need of repairs, require large crews, and their shutdown is not affecting labor seriously. A large loading dock at the Bessemer Rolling Mills, Tennessee company's plant at Bessemer, Ala., is nearing completion.

With two ships building and two keels to be laid soon by the Chickasaw Shipbuilding Co., subsidiary of the Tennessee company, at Mobile, Ala., there is small possibility of operations being curtailed at the company's big Fairfield works, practically the entire product of that plant being rushed to Mobile for use in construction of ships.

No complete shutdown of the Tennessee company's big steel plant at Ensley, Ala., is expected, though curtailment of production has kept pace with the falling off of orders. The Alice furnace in the city proper has been shut down, but this loss of product is offset by the blowing in of a furnace at Bessemer, Alabama.

In general, operators are expecting more activity in May than was to be noted in the preceeding two months. This is particularly true in the iron and steel circles, even though the close of April found only 14 stacks in blast out of a total of 45 in the state.

## Industrial Relations in Canada

VICTORIA CORRESPONDENCE

The Royal Industrial Commission of Canada, appointed by the dominion government to investigate and report upon the relations between employee and employer throughout the dominion, met in British Columbia recently to take evidence. Among others heard was F. M. Sylvester, managing director of the Granby Consolidated Mining and Smelting Co., who expressed the fear that any effort to establish a joint council of employees and employers for the purpose of handling labor problems would have to be confined to units if it were to meet with success. He said that such a joint council might fail "because there is so much difference of opinion and such a wide chasm between the employer and the employee in many industries." In his opinion an organization of the kind should be built from the bottom and extended over a long period.

Mr. Sylvester told the commission that he had not given the question extensive study, but he thought that the results achieved by an industrial council would be in proportion to the provision made for the education of the men. Progress could be only by evolution. Each industry would have to work out its own salvation.

## Villa Raids Annoy Miners

LORDSBURG, N. M., CORRESPONDENCE

Advices received under date of May 13 are to the effect that conditions in Chihuahua and northern Durango, Mexico, are still uncertain. Practically no foreigners are living at places distant from the railroad in that section. There are no white men in Santa Eulalia. Though the mines are operating, the engineering force live in the city of Chihuahua and visit the property two or three times weekly. Even the old-time mine bosses, some of them married to native women, are taking no chances on a raid by Villa, but reside in the city and make the trip, 12 miles, to the mines as often as necessity requires.

At Cusihuiriachic there are a few American operators, but they keep saddle horses and automobiles ready for instant use and maintain a force of mounted pickets to report instantly any suspicious party of horsemen that may approach. Operating under these conditions is certainly nerve racking, but no protection can be depended upon from the Mexican government forces.

## Mining in Dutch Guiana

High freight rates, tax on production, the high price of foodstuffs, and reduction in the purchasing power of gold greatly checked the gold-mining industry in 1917 in Dutch Guiana, according to a consular report. Only one company operated on a successful financial basis. The discovery of bauxite in Dutch Guiana in 1915 has resulted in the establishment of several holding companies, which have done extensive prospecting. A special ordinance for this industry was passed by the colonial parliament some time ago and sent to The Hague for ratification, which, it is expected, will be given soon.

# Progress in the Manufacture of Stoping Drills

*The development of stoping drills to their present status among air-driven rock-cutting machines has been the result of specialization and a consideration of conditions involved in drilling operations. In recent designs the disadvantages of the older types have been eliminated and new features and improvements have been introduced.*

DRILL engineers and manufacturers have appreciated for many years the fact that one type of drill could not be efficiently applied to all conditions of drilling. The old two-man piston drill is now used under a relatively small percentage of conditions. One-man piston drills, water-hammer drills for drifting, rotating hand-feed hammer drills for sinking, and air-feed stoping drills for upper holes are some of the developments of the last 15 years. Specialization in each department of drilling has also been found necessary with increasing competition and with the adaptation of new drills to work previously done by other means with less efficiency.

The first air-feed stoping drills developed were practically all of one type, consisting of the drill cylinder proper, mounted on a reverse air-feed cylinder, in which the feed cylinder remained stationary and the air pressure carried the drill up to its work, supported on a piston rod between the drill proper and the feed cylinder. These machines were designed for hard, medium, and soft ground and for all conditions that might be met in the drilling of upper holes. The Sullivan Machinery Co. was the first to introduce in this country that type of pneumatic feed in which the feed cylinder is attached directly to the pneumatic hammer, the feed piston rod acting against an abutment. This type of pneumatic feed held supremacy for many years, and, in fact, is considered as the standard for non-rotating machines at the present time. Modifications of this pattern included hard-hitting stopers for solid-ground conditions, light-hitting stopers for soft ground, and feed cylinders of different diameters to provide a lighter or a stronger holding power against the rock.

## Essentials of Successful Stoping Drills

All of the earlier types of stoping drills were rotated by hand. According to later demands from the field, the following conditions are essential to the design of a successful stoping drill: light weight and small size, to permit easy handling in high stopes; automatic rotation, to relieve the drill runner of the incessant labor of turning the drill bit by hand, particularly in hot stopes; satisfactory regulation of the strength of the feed; a water jet for laying the dust when drilling in sulphur-bearing ores, or other formations in which dust is injurious to the health of the miner; and automatic lubrication. These are the general outstanding characteristics, to which must be added, in the design of a successful stoper, the usual features of convenience as to handling, cutting speed, air-power economy, simplicity of construction, accessibility for repairs, staunchness, and ability to resist wear and hard service. The first four desiderata need not necessarily all be combined in the same machine, as they represent varying conditions called for by different fields. The last-mentioned features are essential to success in all satisfactory stoping drills.

## New Features Adopted To Conform to Conditions

Drill designers have been studying conditions and developing new features with the object of producing stoping drills to meet more satisfactorily the varying factors of the field. That their efforts have met with success in the types recently introduced may be accepted as demonstrated from the encouraging reports received as to performance and popularity with operators in many characteristic mining districts of the country.

Two new standard stopers are shown in an accompanying illustration. Fig. 1 illustrates the class DT-44

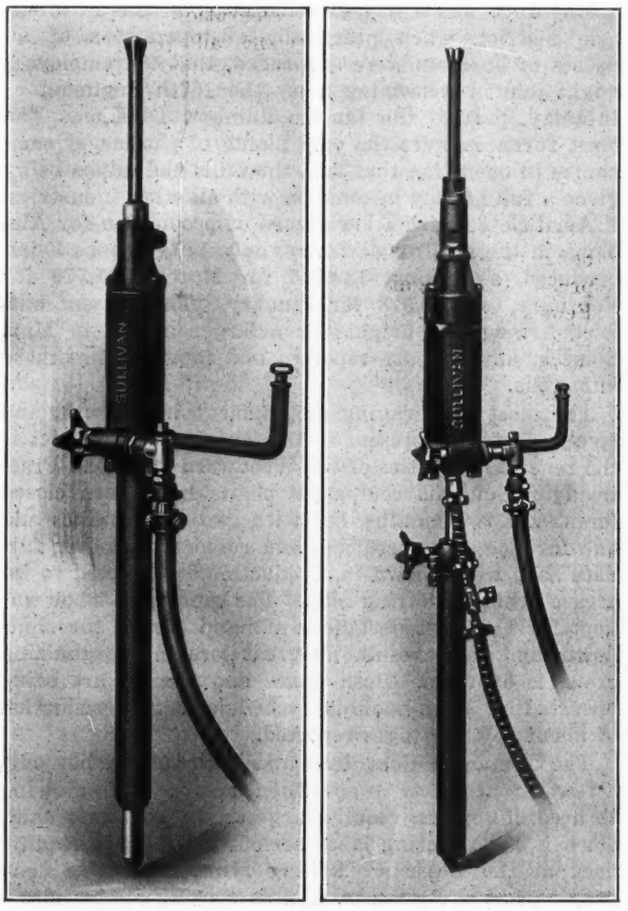


Fig. 1 Fig. 2
TYPES OF STANDARD STOPING DRILLS

light-weight hand-rotation machine and Fig. 2 the class DT-42 stoper, with automatic rotation and water attachment, both made by the Sullivan Machinery Co.

## Variety of Design To Meet Different Uses of Stopers

The ingenuity of the designers and the flexibility of the interchangeable part system permit the following combinations and arrangements to meet different field conditions: a light-weight stoper having hand rotation and direct feed, using solid steel; a light-weight stoper having hand rotation and direct feed, with water at-

tachment, using hollow steel; a light-weight stoper having hand rotation, with reverse feed of either the dry or the water type, for use with solid or hollow steel; a rotating stoper with reverse feed, using solid steel and drilling dry; a rotating stoper with reverse feed, using hollow steel and provided with water attachment; a rotating stoper with direct feed, using solid steel and drilling dry, and a rotating stoper provided with direct feed and water attachment, and using hollow steel.

It is possible to obtain a stoper for practically all field conditions likely to be encountered. The design of the light-weight stoper is such as to permit its use in the most confined stopes, and the light weight enables one man to carry it into narrow working places or up ladders with the least possible inconvenience and difficulty.

### Control of Feed and Positive Rotation Essential in Successful Design of Self-Rotating Stoper

The self-rotating stoper is well suited for use in hot stopes or in other parts of the mine where there is a demand for a labor-saving machine. Heretofore, self-rotating stoping drills have not been of satisfactory design. In this type it is desired to provide a compact, positive means of rotation and to furnish some practical means of retarding the feed, so that in starting a hole or in fitchery ground the feed may be controlled, positively and immediately. The difficulty with previously designed rotating stopers has been that, in these two classes of work, the forward action of the feed, combined with the rotation of the steel, would throw the bit off the inclined surface of the rock, or into the seam or vug, causing a stuck steel or a crooked hole, with almost the certainty of loss of time and labor and frequent damage to the drill itself.

In the design of the rotating stoper an extension bar, forming an integral part of the piston proper, at the front end of the drill, is milled with alternate straight and spiral flutes or grooves, which engage a ratchet collar and a retaining bushing, the latter being screwed into the chuck bushing and transmitting the rotating movement to the drill steel on the return stroke of the piston. The piston delivers a free blow on the drill shank, the ratchet turning with it. It will be noted that the parts comprising the rotation are all at the front end of the tool. There is no separate rifle bar. Experience with these new stopers has demonstrated that this form of rotation is substantial, positive, and reliable.

In their experiments with independent rotating motors mounted at the front end of the machine, the manufacturers found that the increased weight at this point caused the machine to be unwieldy, due to improper balance. The present standard arrangement, though it lengthens the machine, permits the maintenance of good balance, which enables it to be handled with greater ease than would be possible if the extreme front end were overweighted by a bulky mass of metal. The second element in the new rotating stoper, namely, control of the feed, has been the result of much study and experiment, and is provided in these machines by means of a hand retarder or brake.

### Hand-Controlled Pressure-Reducing Valves Unsuccessful

Among earlier unsuccessful developments were pressure-reducing valves under hand control for varying the pressure of the air in the feed cylinder. These failed because of the unreliability of the valve, especially when wear had taken place, with resultant leakage; and because their control and operation are indefinite, as the operator has no means of knowing the extent to which the compressed air has been reduced in the feed cylinder. Feed cylinders of various sizes were also tested, but these, too, were unpopular, because a feed cylinder of any specified size is not sufficiently flexible to enable the operator to adapt the working pressure to varying ground conditions.

In the new machine the control is effected by means of a reverse feed cylinder and piston. A coil brake band controlled by a handle is situated at the front end of the feed cylinder, the band surrounding or gripping the feed piston in such a manner that the air pressure in the cylinder can be counteracted by a turn or two of the hand grip, which is within easy reach of the operator. In spotting a hole with the bit held against the rock by the air pressure, the feed can be so throttled as to make practically an immovable mounting. When the drill has cut a satisfactory collar for the hole, the brake is released gradually, until full feeding strength is secured. The same method is employed for cutting through a seam, loose or broken ground, or a fitcher. By tightening the brake, the rapidity of the feed is immediately reduced to the proper amount, so that the drill does not bury itself in soft ground, or drop out of line in crossing a vug or fitcher. This feature, as demonstrated in actual use in many parts of the country, gives complete adaptability for any ground conditions encountered, from soft broken material to hard, tough, solid rock.

### One Throttle Controls Drill and Feed Cylinder

An important element in the success of the stoper provided with a brake is the method of throttle control. With the hose valve turned to its wide-open position, the control of the drill and feed cylinder is placed under the one throttle. Turning the throttle first admits air to the air tubes and oil pockets, and in the next position to the feed cylinder, which raises the drill to its work. Further turning of the valve causes the hammer to reciprocate slowly, and in the final full-open position the machine is operated at full speed and the feed cylinder receives full pressure.

### Former Types of Water Sprayers Were Open to Criticism

The new water feature, which may be incorporated in either the light-weight stoper or the rotating stoper, solves the problem of laying the dust and cuttings in a satisfactory manner. First attempts to accomplish this object consisted of providing an outside water spray by means of which water was drawn from a bucket through a hose on the injection principle and discharged by air pressure at the side of the drill steel, against the face of the rock. This method necessitated constant refilling of the bucket and was an inconvenience to the operator in many ways. In addition, it was entirely unsatisfactory for drills rotated by hand, and was soon discarded. The next experiment consisted of a water inlet placed at the front or nose of the drill, which took water from a pressure tank or pipe line. The water was then discharged through the hollow drill steel, this action being assisted by the air pressure, which found its way into the drill steel from the front end of the cylinder.

There was considerable leakage, from the front end of the drill particularly, and the miner was likely to be thoroughly wet before the end of the shift. The object

of the jet was accomplished in that it discharged the water against the back of the hole while the drill cuttings were being formed, and laid the dust at that point. The constant leakage of water, however, proved a serious objection. A machine of this type was described by an unsympathetic drill runner as resembling "a beautiful fountain playing in a park."

### Method of Spraying in New Type of Stoper

The form of water jet used in the DT-42 and DT-44 types consists of a water inlet to which a hose is attached from a pressure tank or supply pipe, under control of the same throttle which admits air to the drill and feed cylinder. Water is discharged through a central tube running well into the mouth of the drill steel. This water tube is surrounded by a jet of live air, taken from the back of the drill, which forms an effective seal against leakage at the chuck and also provides the additional pressure necessary to carry the water through the steel against the back of the hole where it is needed. The action of the combined water and air throttle tends to admit a small quantity of air to the tube or air-jet space first; as the throttle is turned to its next position, the water is introduced and brought to play in the drill hole, before the next turn of the throttle starts the piston moving with increasing rapidity. In stopping the machine, the process is reversed, so that, just before the air is finally shut off, a jet of live air blows through the steel, clearing out any water which may remain in it, and preventing this water from falling back into the chuck when the air is shut off.

A detail of design which adds to the drill runner's comfort consists in a deflecting flange or cap, which forms a part of the drill chuck. This shields downward-looking ports for the drill exhaust, so that dust or cuttings falling from the hole are not blown into the operator's face or against the upper part of his body. With the water stoper, these ports serve to carry off, without inconvenience to the runner, any sludge or water which may run down the steel from the hole and find its way into the chuck.

### Automatically Operating Oil Pocket Effects Successful Lubrication

With each stroke of the piston, a measured quantity of oil is drawn from a reservoir in the handle into the working parts of the drill. A supplementary oil pocket in the throttle valve casing is provided, which fills automatically with oil, when the machine is not in operation. On the opening of the throttle, the entrapped oil is blown into the air-inlet passages of the cylinder, after which the automatic lubrication goes into affect. In the automatic-rotation type, the rotating mechanism is lubricated by an independent oiler in the throttle valve, which blows oil into the ratchet chamber each time the drill starts to work. In addition, the chuck housing is furnished with a grease chamber, from which the rotation parts are lubricated.

The new stopers are both of the valveless pattern. The air-thrown piston is of the simplest possible design and the cylinder is of one diameter throughout. In this design, the effort has been made to overcome previous detriments to valveless drills, the high air consumption per unit of work done, and a rapid diminution of efficiency with increased wear. The Sullivan design embodies unusual simplicity in the number and shape of the working parts. The piston is equipped with ample bearing surface, to insure it against wear, and the design is such that, when wear does occur, with inevitable increase of air consumption, the drilling speed will not be materially affected, and the cushion, which is provided at both ends of the piston travel, is still retained in full effectiveness to protect the machine against undue jar and breakage.

The principal factors which determine drilling speed are force and frequency of blow. The relation of these two elements has been so balanced in this design that average ground and air-pressure conditions are met to the best advantage with regard to the shock to which the drill steel is subjected and the wear of the gage of the drill bit.

### Replacement and Interchangeability of Parts

Wearing parts of these machines have been made simple and easy to replace, should wear or breakage occur after long service. All parts are made on an interchangeable system and every part of the machine is constructed of drop-forged steels billets of special alloy metal, or from tool-steel bars, the wearing surfaces being thoroughly heat-treated by special processes which are the results of long experience in this branch of manufacture.

## Classification and Compensation Of Engineers

Engineering Council has for some time been working upon the classification and compensation of engineers. It has organized a committee to investigate the matter, the membership of which is as follows: Arthur S. Tuttle, deputy chief engineer, Board of Estimate, New York City, chairman; Francis Lee Stuart, formerly chief enginer, Baltimore & Ohio R.R., and consulting engineer, U. S. Railroad Administration; John C. Hoyt, hydraulic engineer, U. S. Geological Survey; Charles Whiting Baker, consulting engineer, New York City, and M. O. Leighton, consulting engineer, Washington, D. C.

The work of the committee may be divided as follows:

1. Determination of the various classes of engineering positions.
2. Collecting data in regard to compensation now paid for each class.
3. Determining an equitable rate of compensation for each class.

Among the basic factors for determining compensation are:

1. Amount necessary to sustain the individual and his dependents properly.
2. The worth of the position occupied, as determined by the importance of the product.
3. The worth of the employee, as measured by his qualifications and efficiency.

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**Tasmania's Mineral Production** or 1918 has been officially reported by the Secretary for Mines as follows, the items being arranged in order of descending value: Blister copper, 5559 tons; tin ore, 2256; zinc, 3822; silver-lead ore, 7241; osmiridium, 1607 oz.; gold, including gold contained in blister copper, 10,529 oz.; scheelite, 216 tons; coal, 60,163; wolfram, 155; asbestos, 2854; iron pyrites, 5106; copper and copper ore, 444; bismuth, 5; barytes, 217; ocher, 100 tons. The total value of the mineral products was £1.750,574, an increase over the preceding year of £166,284.

## Exposition of Chemical Industries

The Fifth Annual National Exposition of Chemical Industries will be held this year in Chicago, at the Coliseum and First Regiment Armory, during the week of Sept. 22, and, as usual, a number of other meetings will be held at the same time. A program is in preparation which includes the general meetings of the American Electrochemical Society, of the American Institute of Mining and Metallurgical Engineers, and of the American Ceramic Society.

The Chicago Section of the American Chemical Society will have headquarters at the exposition, where it is probable that a meeting will be held. The Mining Institute is arranging to conduct a pyrometry symposium, which will consider several phases of the subject as follows: Methods of Pyrometry, Industrial Pyrometry, Pyrometry and Its Relation to Science. Special stress will also be laid upon the iron and steel industry by the Institute.

The management has made arrangements to engage the First Regiment Armory for exhibits and meetings of some of the societies. The armory faces the next parallel street, which is Michigan Boulevard and is divided from the Coliseum only by a narrow alleyway, across which visitors will step from exhibit to exhibit. The managers report that much of this space is already engaged. It is expected that there will be a larger number of exhibitors than at a similar period last year, and many new companies which have not formerly exhibited will take advantage of the exhibition to demonstrate and display their various products.

During exposition week, no other conventions will be held in Chicago except those invited by the exposition, and this fact should assure adequate hotel accommodations for the visitors who will go to the city. The office of the management of the exposition will be transferred on June 1 from New York to 417 South Dearborn St., Chicago.

## Westinghouse Company To Establish Memorial Scholarships

As a suitable and appropriate war memorial to the more than 8000 employees of the Westinghouse Electric and Manufacturing Co. who entered the service of the Government in the Great War, the company has decided to establish a number of technical scholarships. Some of the details of the plan by which this will be done have been given out by E. M. Herr, the president, as follows:

Four war memorial scholarships will be established each year under the following general conditions: Candidates will be limited to sons of employees of the Westinghouse Electric and Manufacturing Co. and its subsidiaries who shall have been employees in good standing for a period of five years. Two of such annual scholarships may be open to the younger employees of the company or its subsidiaries who have been in their service for a period of at least two years and who do not exceed the age of twenty-three. The selection is to be determined by competitive examination to be conducted annually by the Educational Department under the direction of a committee.

Scholarships will entitle the successful candidate to pursue a four years' course in any technical school or college that he may select, with the approval of the committee. The scholar may pursue a course in any branch of engineering that he may select. Scholarships will be granted for one year only, but will be continued for the full four years, provided the scholar pursues a course in any branch of engineering that he may select. Each scholarship carries with it an annual payment of $500, to be made in two installments, and the number of new scholarships will be four each year.

It is the intention to continue these memorial scholarships from year to year, but the company reserves the right to recognize changing conditions and to modify the plan or to discontinue it entirely.

## Manganese Mines in Ecuador

The manganese mines of Ecuador are near the town of San Antonio, Province of Pichincha, Ecuador, according to a consular report. They are owned by Dr. Alejandro Cardenas, of Quito, and are registered under the name "Belsaida." The claims cover an area of about 1½ square miles.

The principal deposit so far discovered consists of a blanket vein 3 to 9 ft. thick, and an extension of about 21,000 sq.ft., a portion being exposed. Samples from many other deposits in the vicinity, of undetermined extent, appear to be of similar quality. Work was begun at the principal deposit in February, 1918, with a limited force and in a primitive manner, about 5 tons being the daily output with 10 men working. The ore extracted was dried in the open air and bagged for export.

An assay made by F. Hunt, of New York, showed the following percentages: Manganese, 46.36; iron, 1.55; copper, 0.02; phosphorus, 0.14; silica, 6.44. Other samples showed 53.2% of manganese. Some have a higher percentage of silica, and still others show limestone. The small quantity of phosphorus should be noted. The mines are 7874 ft. above sea level. The climate is healthful; and the rainy season lasts from January to April, with a small rainfall. The district is wholly volcanic, partly covered with sand. The Guaillabamba River passes through a deep gorge near by.

No experienced miners are available, but the native workmen, of which the supply is sufficient, are easily managed, and learn readily under kindly direction. A 10-hour day is in effect. The foreman receives daily less than 50c.; laborers are paid 35c.; women, 30c.; and boys, 20c. The women and boys carry the ore from the mine to the drying place, and crush and sort the product.

Quito, the railway terminus, is 28 miles from the mine. The road is fairly passable to mule traffic, and could be fitted for wagons by constructing a small bridge. The supply of mules is sufficient—400 to 500 animals being available—and the present cost of transporting one mule load of 220 lb. is 68c., U. S. currency.

The railway rate from Quito to Guayaquil is about 1c. U. S. currency, a pound for ore in bags. No export duty is exacted. The lighterage and other port charges are $1.50, U. S. currency, per ton.

**Zinc Production in Japan in 1917** amounted to 53,852 long tons, according to a note in *The Ironmonger*. The probable output of zinc during the first half of 1918 was about 10,983 long tons, this indicating a decrease which is probably due to the great reduction in imports of zinc ore from Australia and Tonkin during 1917, and to the decrease in the imports of old Chinese copper ("cash") which were exceptionally large in 1917 and yielded about 20% zinc when melted.

# Company Reports

## Anaconda Copper Mining Co.

The annual report of the Anaconda Copper Mining Co. for 1918 shows that the profit for the year, before charging depreciation of $6,104,185.43, amounted to $26,907,055.47. The profits of the last three months of the year were absorbed by the adjustment for inventory purposes to a cost basis of copper which had been reported in the September estimate as sold at 26c., the orders for which were subsequently canceled by the Government.

The mines of the company produced during the year 4,918,468.30 tons of ore and 6553.69 tons of precipitates, a total of 4,925,021.99 tons. During the year 1918, a total of 41.85 miles of development was done in the mines, in the form of drifts, crosscuts, raises, shafts, and winzes, as compared with 38.61 miles during 1917. Shafts were sunk additional depths aggregating 4991 ft. The results of development work were satisfactory.

The copper reduction works treated for all companies during the year, 4,959,580 tons of ore and other cupriferous material in Anaconda, and 57,000 tons of ore and other cupriferous material at Great Falls. Of this amount 4,350,446 tons of ore was produced by company mines, 618,256 tons of ore was either purchased from or treated for other companies, and 47,878 tons of precipitates and cleanings from the old works at Anaconda and Butte was treated. At Anaconda, 279,030,318 lb. copper, 10,001,604.81 oz. silver, and 59,403.116 oz. gold were produced. At Great Falls, 14,573,408 lb. copper, 966,300.31 oz. silver and 4914.506 oz. gold were produced.

The electrolytic copper refinery at Great Falls produced, during the year, 191,404,125 lb. of cathodes, 189,067,167 lb. of which was melted into shapes at Great Falls. The copper-leaching plant at Anaconda treated during the year 500,688 tons of tailings and 64,978 tons of copper ore, from which there was produced 6662 tons of cement copper.

The zinc plants at Anaconda and Great Falls treated during the year 393,193 tons of ore and other zinkiferous material, of which amount 255,057 tons of ore was produced by mines of the company, and 138,136 tons of ore and concentrates were purchased from other companies. At Great Falls, during the year, 72,131,238 lb. of electrolytic zinc was produced. The electrolytic-zinc plant operated continuously throughout the year, with excellent results, as every effort was made to secure as great an output as possible, in order to meet the requirements of the Government. The zinc produced, on account of its purity, was used largely in munition work.

In South America, at the property of the Andes Copper Mining Co., additional churn drilling was done, aggregating 11,800 ft., by which approximately 5,000,000 tons of ore was added to the reserves. Drifts and raises amounting to 2990 ft. were driven, exploring different sections of the mine. In connection with the water supply, 295 ft. of tunnels was driven, and 15 miles of wagon road, over which supplies for pipe lines will be transported, was completed. Living quarters of the employees will be situated at the mill site.

## Shattuck Arizona Copper Co.

The Shattuck Arizona Copper Co. reports for the quarter ended Mar. 31, 1919, that it was necessary to suspend mining operations Feb. 22, 1919, because of a fire which started between the 700- and 800-ft. levels in the oldest workings of the mine, known as No. 1 stope. The ores produced from this section were massive sulphide of iron and copper from which most of the commercial copper ores had been extracted. Part of the section was filled with low-grade pyritic material and the territory had been abandoned. The only openings remaining here were air courses kept open to ventilate the filled section, which has been developing considerable heat during the past two years.

Fire gases were noticed coming from the old air courses on Feb. 14, and attempts were made, without success, to reach the burning sections and extinguish the fire by water sprays. On Feb. 22 the volume of gas and sulphur smoke pouring out of the shaft was so great that it was no longer safe to attempt mining operations, especially because the workmen on all levels of the mine above the 700 were being made sick by gases which penetrated all the upper levels. The men were returned to the surface safely, and trained helmet crews were put to work bulkheading off the fire area, and preparations made to flood the mine between the 700- and 900-ft. levels. Flooding operations started on Feb. 23, and it is estimated that 18,000,000 gal. of water will be required to fill openings, not allowing for seepage. Water amounting to 350,000 gal. per day has been pumped into the mine. On Mar. 31 the water reached a level 50 ft. above the 800 level, and it is gaining approximately 1 ft. per day. All the available water in the district is being used, and results of the flooding operations to date can be considered satisfactory. Sulphur gases are no longer noticeable, but considerable wood gas continues to be noticeable from the burning section. Mining operations will be resumed when the workings are made safe for the company's employees.

The production for the first quarter of 1919 is as follows: Copper recovered, 1,000,844 lb.; gold recovered, 160 oz.; silver recovered, 44,129 oz.; lead recovered, 678,914 lb. The loss on operations, exclusive of depletion, amounted to $163,988.30.

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## Nevada Consolidated Copper Co.

The quarterly report of the Nevada Consolidated Copper Co. for January to March, 1919, shows that the production of copper was 12,201,444 lb., as compared with 19,020,773 lb. for the preceding quarterly period.

During the quarter 529,692 dry tons of Nevada Consolidated ore, averaging 1.79% copper, was milled. Of the tonnage milled, 65% was supplied from the pit and 35% from the underground workings of the Ruth mine. In addition to the treatment of company ores, 8105 tons of customs ore was concentrated, and the resulting concentrates, together with 12,198 tons of customs ore and concentrates, were smelted at the Steptoe plant during

the quarter. The cost of production per lb. of copper was 16.85c. Miscellaneous earnings, including the value of gold and silver recovered, amounted for the quarter to 2.34c. per lb. of copper. When it is realized how seriously Government regulation affected the cost of production, the results obtained during the first quarterly period following release from Federal restrictions may be considered encouraging in their indication that many of the conditions responsible for high costs can be further, although gradually, remedied.

The operating loss amounted to $192,613.67; miscellaneous income was $81,454.55, distributions to stockholders were $749,796.38, and net deficit was $860,955.50.

The company has on hand sufficient refined copper to meet immediate demands, and will not increase production until such time as a revival in the trade and return of normal industrial conditions justify that course.

## Magma Copper Co.

The Magma Copper Co. of Superior, Ariz., reports net earnings for the year 1918, disregarding depletion, at $519,350. The net cost of producing copper, not including depletion, but including depreciation and all other charges and deducting the revenue from the gold and silver, was 16.425c. per lb. The average price received for about 60% of the production was 25.05c. per lb. The remainder of the production, about 40%, is carried at 15c. per lb. For the preceding year the cost and selling prices were 16.01c. and 26.423c. per lb., respectively. Net production for the year, after deducting all smelting and refining losses, was 10,968,556 lb. copper, 463,503 oz. silver, and 5699.4 oz. gold.

During 1918, 90,321 tons of ore was mined, of which 7.04% came from development and 92.96% from stopes. The cumulative tonnage of all classes of ores since the beginning of operations up to the end of the year is 382,680. The ore reserves are estimated as 235,000 tons (copper, 5.7%; silver, 4.2 oz.; gold, 0.02 oz. per ton) reasonably assured copper-sulphide ore and 20,000 tons (zinc, 13.5%; lead, 2%; silver, 12 oz. per ton) of reasonably assured lead-zinc ore. At the mill, 74,441 tons of ore was treated (mill heads were copper, 4.496%; silver, 3.803 oz., and gold, 0.05 oz. per ton), and 29,588 tons concentrates was produced (copper, 10.78%; silver, 9.41 oz., and gold, 0.1379 oz. per ton); a recovery of 95.33% of the copper in the mill heads. The development during the year totaled 11,122 feet.

## Ray Consolidated Copper Co.

The quarterly report of the Ray Consolidated Copper Co. shows that the gross production of copper contained in concentrates for the first three months of 1919 was 19,601,149 lb. In addition, a total of 180,348 lb. of copper was contained in the ores sent direct to the smeltery, making the total gross production from both sources for the quarter 12,471,729 lb. During the quarter 440,200 dry tons was milled, averaging 1.793% copper. The mill extraction for the quarter was 77.88% of the total copper contained in concentrating ores.

The milling cost for the quarter was $1.19 per ton, as compared with $0.95 for the previous quarter, exclusive of Federal income and excess-profits tax. The average mining cost of ore milled for the quarter was $1.70 per ton, of which 5.97c. was the cost of coarse crushing, leaving the net mining cost $1.64 per ton, as compared with $1.80 for the previous quarter, both exclusive of income and excess-profits taxes.

Operating deficit amounted to $244,667.21, miscellaneous income, $92,369.16, and disbursement to stockholders, $788,589.50. The net deficit for the quarter was $940,887.55.

Total dividend distributions from the beginning of the company's operation to the end of the first quarter of 1919 have amounted to $21,469,673.17.

## Tonopah Extension Mining Co.

The annual report of the Tonopah Extension Mining Co., for the year ended Mar. 31, 1919, shows that 114,921 tons of ore was mined and milled, which carried an average of 12.818 oz. silver and 0.121 oz. gold per ton. The recovery is given as 93.05%, and the total costs were reported as $8.488 per ton. The increase in the cost of milling is attributed largely to the inferior quality of iron, steel, and pebbles used, together with the increased cost of these materials.

A total of 10,322 ft. of development work was done during the year. The nature of the orebodies is said to preclude accurate measurement of ore in sight, and no definite figures are given. Dividends were distributed amounting to $192,406.83, representing 15% on each full share of stock outstanding.

## Amparo Mining Co.

The Amparo Mining Co. report for the year ended Dec. 31, 1918, states that the results of the year have been better than were expected. The amount of ore mined and treated at the mill amounted to 120,046 tons. Costs show a reduction from $9.93 a ton to $8.60 a ton, as compared with 1917. The theoretical extraction of gold and silver amounted to 89.3%, but no actual recovery figures are given. In addition to gold and silver bullion, the products from the mine were concentrates, slag, and short zinc.

Development in the mine has been so satisfactory that the tonnage of milling ore in sight shows a decided increase over that of last year. The settling of slime has been a serious problem, and new vats are now being installed. A new tube mill is also being erected.

Dividends paid during the year amounted to $300,000.

## Wallaroo & Moonta Mining and Smelting Co., Ltd.

The Wallaroo & Moonta Mining and Smelting Co., Ltd., according to the annual report for the year ended Dec. 31, 1918, earned a profit for the year of £69,907 2s. 1d. after providing for royalty on mineral leases (£1636 5s.) and state income tax for 1917-1918 (£9844 0s. 7d.). Dividends paid amounted to £80,000.

The total ore produced from the Wallaroo mines was 54,501 tons, containing 8.91% copper. The Moonta mines produced 8782 tons, containing 14.73% copper. The cementation plant at the Moonta mines produced 790 tons of precipitate, containing 555 tons of copper. The Wallaroo smelting works treated during the past year 68,199 tons of ore, precipitate, and blister. The following metals were produced: 9390 tons of refined copper, 1454 tons of electrolytic copper, 2992 oz. fine gold, and 1608 oz. silver, 996 fine. The production of sulphuric acid was 6745 tons.

## Mason Valley Mines Co.

During 1918, the refined-copper production of the Mason Valley Mines Co. was 15,475,851 lb., including metal obtained from outside sources, 88% of which was produced by the Bluestone Mining and Smelting Co. and the Nevada-Douglas Consolidated Copper Co. Two furnaces were in blast until Apr. 27, 1918, at which time one was shut down, and on Feb. 28, 1919, the other was closed. During 1918, a total of 336,943 tons, of which 118,251 tons was mined from company properties and those held under option, was smelted.

Development work at claims was as follows: At the Mason Valley group, 3296 ft. of raises, drifts, and crosscuts; Majuba Hill, 750 ft. of drifts, crosscuts, raises, and winzes, and an advance of 1900 ft. in No. 3 tunnel; and a total of 2793 ft. of drifts, raises, winzes, and crosscuts at the Gray Eagle group. Net profit for the year, after deducting interest, taxes, exploration charges, and depreciation, was $174,261.93.

## Old Dominion Co.

The Old Dominion Co. in 1918 produced 72,588 tons of smelting ore, 153,166 tons of concentrating ore, and 4697 tons of converting ore, having an average content of 4.52% copper. Total metal production for the year, including that obtained from custom ores, was: Copper, 33,378,158 lb.; silver, 184,982 oz.; and gold, 5071 oz. Total development work done was 22,163 ft., distributed as follows: Sinking, 256 ft.; drifting, 10,477 ft.; raising, 5589 ft., and intermediate work, 5841 ft.

In the concentrating department, 226,998 tons, which includes custom ore handled, of an average grade of 3.90% copper, was milled, compared with 199,575 tons, of 3.78% copper, in 1917. There was smelted 165,028 tons in 1918, compared with 198,548 tons in 1917. Income from sales of metal was $5,731,082.29, and total expense, including mining, treatment, refinement, plant depreciation, administrative expenses, and taxes, was $5,125,125.19. Deducting a provision of $304,195.32 for depletion of mines, the net income for 1918 was $301,761.78. Four dividends of $297,071 each were paid.

## Mining Corporation of Canada, Ltd.

For the year ended Dec. 31, 1918, the Mining Corporation of Canada, Ltd., according to the company's annual report, produced 1,708,252.41 oz. of silver. In the preceding annual report, the ore reserves at the end of 1917 were stated to contain 1,545,370 oz. The production during 1918 was therefore considerably more than the estimated reserves. The tailing-treatment plant is now in successful operation, and the quantity of silver remaining in the tailing beds must be taken into consideration.

The price realized during 1918 for silver averaged 110.11c. per oz., as against an average of 88.09c. for 1917. The net profits for the year, after writing off the proper amounts for depreciation and special expenditure, were $925,760.38; and after payment of the four quarterly dividends there is to the credit of profit and loss account $3,025,347.45.

The total amount of exploration and development work carried out in 1918 amounted to 6540 ft., as compared with 8494 ft. for 1917. The total tonnage treated was 60,114, the total ounces recovered being 1,708,252.41, of which 245,895.34 oz. was from high-grade ore.

## New Idria Quicksilver Mining Co.

The annual report of the New Idria Quicksilver Mining Co. for the year 1918 shows that the production of quicksilver amounted to 10,700 flasks, as compared with 11,000 flasks for the previous year. Operations were conducted under difficult and abnormal conditions, on account of the war, scarcity of labor, and scarcity and high cost of supplies. A large amount of construction work was, however, done. Five rotary-kiln furnaces have been installed, one of which, begun in 1917, was fired in April, 1918, and was operated continuously for the rest of the year. Two of the others were nearly completed and ready for operation at the end of the year, and the remaining two have been recently completed. These furnaces will have a total roasting capacity of from 400 to 500 tons per day.

About 40% of the company's total production was supplied to the Government on direct contract, and additional quantities were furnished for the uses of the Government and its allies on specific orders during the year. By agreement with the War Industries Board, the price on Government requisitions was made $105 per flask. The average price in the open market for the year was about $125 per flask.

During the year the company was notified by the War Industries Board that Government requirements of the year 1919 would be largely in excess of 1918, and construction work was therefore carried on with all possible dispatch in order to be in position to fulfill these requirements. The ending of the war, however, caused a radical change in the situation, and in October the Government advised that requirements for 1919 would be smaller than for the last year. The construction work then under way was so far advanced, however, that it was deemed expedient to complete it. Net proceeds from the sales of quicksilver during the year amounted to $1,311,393.81; operating expense, depreciation, and depletion totaled $1,101,204.96; and the operating profit, subject to reserve for Federal taxes, was $167,540.46.

## Arizona Commercial Mining Co.

The operations of the Arizona Commercial Mining Co., at Globe, Ariz., for the year 1918 consisted in additional development measuring 6729 ft., as compared to 3545 ft. in 1917. The tonnages and grade of ore extracted during the year are given in the table:

| | 1918 | | 1917 | |
|---|---|---|---|---|
| | Dry Tons | Per Cent. Cu | Dry Tons | Per Cent. Cu |
| Smelting ore | 11,712 | 10.268 | 12,686 | 9.640 |
| Concentrating ore | 51,052 | 4.863 | 27,015 | 4.521 |
| Secondary smeltery products | 18 | 17.760 | ..... | ..... |
| Lease ore | 13 | 5.620 | ..... | ..... |
| Totals | 62,796 | 5.874 | 39,702 | 6.153 |

The production from the 62,796.9 tons of ore was 6,076,303 lb. copper, 15,980.7 oz. silver, and 830.62 oz. gold. The income before providing for depletion is given as $270,158, and, after deducting the depletion, $156,912, the net income is $113,246.

**Quarterly Report Chief Consolidated.**—The report for the first quarter of 1919 of the Chief Consolidated Mining Co. of Arizona, operating the Chief Consolidated mine and the Plutus Mining Co., at Eureka, Utah, gives a total new development footage of 5070 ft., and shipment of 15,170 tons, which yielded over smelting, transportation, and sampling charges, $413,261. The net profit for the quarter, after payment of all charges, was $125,304.

# Industrial News from Washington

By Paul Wooton, Special Correspondent

## War-Minerals Claims Exceed Available Funds

With the statutory limitation of the time for filing claims approaching, the War-Minerals Relief Commission is being almost swamped by the inrush of late claims. The aggregate of the amount asked by the claimants may exceed $10,000,000, or $1,500,000 in excess of the entire amount allowed by Congress to settle the claims and pay the expenses of the commission. At the close of business on June 2, after which no further claims will be received, it is believed that there will be no less than 1200 claims on the docket of the commission.

The larger claims received during the week ended May 21 were filed by the following: F. H. Nett, San Bernardino, Calif.; Eagle Mine, Denver; Markstein-Dorn, Atlanta; M. A. Delano, Palo Alto, Calif.; Robert Brown, San Francisco; Tres Amigos Co., Los Angeles; G. C. Grimmett, Kerby, Ore.; Joseph Migliore, New York; Henry Lockhart, New York; S. J. Gish, Central City, Ky.; Bill-Jim Mineral Co., Holdenville, Okla.; S. H. Dolbear, San Francisco; Down Town Mines Co., Leadville, Colo.; U. S. Manganese Mining Co., Hollywood, Calif.; J. G. Murphy, Guadalajara, Mexico; R. B. Miller, Bluefields, W. Va.; H. W. Smith, Santa Fé, N. M.; A. L. Wakeham, Oroville, California.

## Mineral Resources of Western Talkeetna Mountains, in Alaska

Increased interest is being shown in the mineral resources of the western Talkeetna Mountains, in Alaska, which may now become available through the building of the Government railway in that region. Discussing the general geology of the district, Stephen R. Capps, of the U. S. Geological Survey, says:

"The striking feature that at once becomes apparent on inspection of the geologic map of the western Talkeetna Mountains is the great predominance of igneous materials over sedimentary rocks. Great areas of deep-seated granite intrusives, older deformed lava flows, and little-disturbed Tertiary lavas occupy almost all the region, in which the hard rocks are exposed, and the granitic rocks and older lavas doubtless extend westward beneath the mantle of unconsolidated materials. Except for a narrow and interrupted belt of sediments that crosses the basins of Sheep River and Iron Creek, and a few isolated outliers of this group of sediments, with some materials of sedimentary origin intimately intruded by granite rocks in the area between lower Sheep River and Iron Creek, the entire western Talkeetna Mountains are composed of igneous materials.

"Most of the orebodies are due to the replacement, along zones of faulting and shearing, of andesite-greenstone by metallic minerals, but one or two have some of the aspects of contact-metamorphic deposits, though they lie at some distance from the contact of the diorite and greenstone. So far as is known, the free-gold content of the ores is not sufficient to justify the installation of crushing and amalgamating machinery. The base character of the ore will necessitate smelting for the recovery of the copper and gold. The ores contain large amounts of metallic minerals, in addition to those which carry the copper and gold, so that concentration, to reduce the weight and bulk of the ores shipped, is likely to offer difficulties. The imperative need is cheap transportation, and that can be obtained for this camp only by the construction of a branch line of the Government railroad."

## U. S. Mineral Resources

A preliminary report on the mineral resources of the United States for the calendar year 1918 will be issued by the Geological Survey about July 1. The report will include general tables for all mineral products, showing production, imports, and exports of the year 1917 and 1918, and will contain, for each of the principal mineral commodities, separate tables showing production, imports, and exports from 1913 to 1918. This report will not supplant any of the regular reports of the Survey.

Most of the statistics of mineral production compiled by the Geological Survey have been made public in the form of press bulletins or of separate reports dealing with individual commodities. These are issued long in advance of the appearance of the final two-volume work on mineral resources of the United States. It is believed that the assembling, in addition, of statistics for all mineral commodities in a single small pamphlet, to be issued within six months after the close of the year to which the statistics relate, will be of considerable utility and convenience to the mineral industry.

## Decrease in Mine Accidents

The notable decrease in the number of fatalities in mines in the United States thus far this year leads to the hope that a new record will be established in the prevention of accidents in mining operations. It is realized by the statisticians in charge of the work that a much smaller amount of material is now being produced by the mines, but, even taking this factor into consideration, accidents are not occurring as frequently as in previous years. Some are of the opinion that the greatly decreased number of non-English speaking workmen now engaged in American mines is one of the potent causes of decreased accidents. Indirect causes of accidents, as a rule, are not taken into account in the average compilation of accident figures, but many contend that the ignorance of new workmen, especially when they are foreigners without mining experience and with no knoweldge of English, is a more potent factor in causing accidents than is generally supposed.

For the last four years, immigration has been cut off. As a result, even the ignorant foreign miners of four years ago now have a working knowledge of English and have become fairly accustomed to their duties. Under normal conditions, a considerable por-

tion of mine labor is recruited from Croatians, Montenegrins, Italians, Russians, Poles, and Slovenians. Figures show that only a small percentage of those applying for work in mines ever have had experience in that class of work. Most of them were farmers in their native lands.

## Bureau of Mines Oil-Conservation Investigation

A study by the Bureau of Mines of means to prevent waste of oil and gas in the Wyoming field has been made possible by voluntary contributions from the Midwestern Refining Co. and the Ohio Oil Co. The former company contributed $20,000 for the work, and the Ohio company $10,000. The investigations will be entirely under the direction of the Bureau of Mines. In making the appropriation, the donors referred to it as "industrial appreciation for the valuable work already done by the Bureau of Mines."

## National Museum's War Work

During the Great War the National Museum's department of geology was called upon frequently for materials for experimental work in connection with the activities by the Bureau of Standards, the Naval Experiment Station, the Department of Agriculture, the Geological Survey, the Carnegie Institution, and various arsenals. One call from the Bureau of Standards was for 27 varieties of minerals, many of which were rare. The head curator of geology at the request of the National Research Council took over the entire work of securing optical quartz for the needs of the United States and Great Britain. The division of mineral technology, in addition to furnishing a large amount of special data to the Army and Navy and a number of Government boards, published several pamphlets on the fertilizer, fuel, sulphur, and power situations, of particular value to the Government bureaus handling these products.

## Germany's Chemical Trade in The United States

America's dependence upon Germany's chemical industries before the war is pointed out in great detail in a census of chemical imports issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, with the coöperation of the American Chemical Society. The purpose of the bulletin is to show to American manufacturers the extent of the domestic markets for the various chemical lines that are now being manufactured in this country, but which had not previously been produced here.

It is shown that nearly $45,000,000 worth of manufactured chemicals were imported into this country in 1914, not counting dyes, which the Bureau has covered in a previous bulletin. Of this total more than 40% came from Germany, which was the chief source of supply. These German chemical products included a great many that could not be obtained from other countries, because they were patented or because the secret of their successful manufacture was not known in other countries. Some of them, especially the medicinal preparations, were of prime importance, although expressed in monetary terms the imports do not seem impressive.

A great obstacle in the way of getting the manufacture of these formerly imported articles started in this country has been the fact that no one knew to what extent there was a market for them, and it was to supply this detailed information that the Bureau of Foreign and Domestic Commerce and the American Chemical Society undertook the compilation of a report on this subject. Firms which are obtaining German patents from the Chemical Foundation, recently organized under the direction of the Alien Property Custodian, expect to find in the statistics the facts they need to plan their operations intelligently.

In addition to being the chief source of imports of dyes and other coal-tar products, acids, fertilizers, and a long list of other chemicals, Germany normally supplied this country with large quantities of allied products, such as paints, pigments, and varnishes, all of which are shown in detail in the report. Imports by quantity and value of 2500 products are included, and there is a list of 3000 other products imported in amounts less than $100 each. For most of these products, the import statistics are now printed for the first time.

The title of the bulletin is "Chemical and Allied Products Used in the United States," Miscellaneous Series No. 82. Copies can be purchased at 25c. each from the Superintendent of Documents, Government Printing Office, Washington, D. C., or from any of the district and coöperative offices of the Bureau of Foreign and Domestic Commerce.

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Only 8% of the officers discharged from the Army up to May 3 have requested assistance in the obtaining of employment. The total number asking aid was 8309, of which 835 were technical engineers, 143 were chemists and metallurgists, and 15 were miners.

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A law of Jan. 14, 1919, provides that the new use of natural products in Uruguay, or the first form of their industrial utilization, shall confer upon the discoverer the right of exclusive exploitation for the time and under the conditions fixed by the law of Nov. 13, 1885, regulating patent privileges, says a consular report.

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The foreign-trade situation with regard to several mineral commodities is to be considered by the interdepartmental committee which has been created at the instance of the State Department. The committee already has gone exhaustively into the coal and the petroleum situations and has considered potash at one meeting. Nitrates, tungsten, chromite, manganese, magnesite, and zirconium will be taken up in the near future, it is expected.

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Lectures on geological subjects have been delivered recently before the West Point post-graduate classes now at Camp Humphreys by George Otis Smith, P. S. Smith, W. C. Alden, and O. B. Meinzer, all of the Geological Survey. The West Point men, who were graduated after having completed three years of the course, as a result of the war, now are rounding out their work at Camp Humphreys. A series of lectures on mining engineering is to be given in the near future by members of the staff of the Bureau of Mines.

## General Goethals Honored by Engineers

In recognition of his distinction in the engineering profession and as the builder of the Panama Canal, Maj. Gen. George W. Goethals has been awarded the John Fritz Medal. Presentation of the gold medal, with an engraved certificate stating the origin of the medal and the specific distinction, was made by Ambrose Swasey, past president of the American Society of Mechanical Engineers, in the presence of a large and appreciative assemblage of engineers and guests in the auditorium of the Engineering Societies Building, 29 West 39th St., New York City, on Thursday evening, May 22.

Addresses were made also by Henry L. Stimson, former Secretary of War, and W. L. Saunders, past president American Institute of Mining and Metallurgical Engineers, testifying to the perseverance, skill, singleness of purpose, and devotion to duty by which General Goethals has brought to a successful completion one of the greatest works of the ages and placed him on the list of men whose engineering achievements are known the world over.

Mr. Swasey in his address said General Goethals had gone to war with the elements when his country was at peace, and had truly represented himself in the ten years' fight on the canal job as a soldier, an engineer, and a man.

In responding, the General said several other men came to his mind in accepting the medallion, chief among them being the late Colonel Roosevelt, whose courage and steadfastness as the chief executive of the nation made the canal possible. General Goethals recalled how the medical men of the army conquered the yellow-fever scourge only after several of the best among them died and others were left permanent cripples for their sacrifices, which he compared to any that had occurred in the world war. In concluding he paid a tribute to the 50,000 American workmen who did their part, imbued solely with the idea that their efforts meant the future glorification of the country's greatness.

The John Fritz Medal was established in 1902 in honor of John Fritz, of Bethlehem, Penn. The medal is of gold, is awarded not oftener than once a year, and is accompanied with the engraved certificate. This certificate states the origin of the medal, the specific achievement for which the award is made, and bears the names of the members of the board by which the medal was awarded and the signatures of the president and secretary of the board. The board of awards is formed of sixteen men, four representatives from each of the four national societies of civil, mining, mechanical and electrical engineers. The first award of the medal was made to John Fritz at a dinner given to him on his 80th birthday, Aug. 21, 1902. Among those who have received the medal in past years are George Westinghouse, Alexander Graham Bell, Thomas A. Edison, Charles T. Porter and Prof. John E. Sweet.

## Michigan Copper Sales and Production

HOUGHTON CORRESPONDENCE

Michigan copper mines now are selling metal at 50% of normal. Sales made recently by the producing interests of the Lake Superior copper district are at the rate of 10,000,000 lb. of copper for the month of May. This is the first time in six months that the metal sales of the Michigan mines have come up to the total of production. Production is lower than ever before, but June output will be lower than that of May.

A decidedly more cheerful attitude is observed among the larger producing interests of the district relative to the future. Though there has been no diminution in the total amount of copper on hand in the district, and though the total is larger than ever before in the history of the industry, the fact that the shipments on bona-fide sales are large enough to take the present output is a favorable feature.

Two important factors are believed to indicate a gradual betterment in the copper-metal situation, from the point of view of Michigan producers. One is the fact that the general market now is absorbing half the normal output of the mines, and that this business is entirely domestic, indicating a general improvement in construction work that calls for copper in the United States. Though it is well known that the mines cannot expect to go back to full-time production until the foreign demand makes itself felt in the market, the knowledge that much of the domestic buying is for copper wire is considered a good sign.

None of the Calumet & Hecla group of mines will show any increase in output. As a matter of fact, 50% figures will be achieved in May and production may go below that in June. One important source of copper production was cut off by the Calumet & Hecla in the week of May 22 when the dredge that furnished the sand from the sand pile in Torch Lake went into drydock. This shuts off 850,000 lb. a month. The dredge is in dock for repairs. It has operated continuously for five years. The plan to make extensive repairs was made more than a year ago, when the drydock was built at Point Mills, five miles from the scene of the dredge operations in Torch Lake. The big dredge was towed through Torch Lake and the canal into Big Portage to the specially constructed drydock.

The exodus of workmen from the district practically has ended. No more men are being laid off by the Calumet & Hecla, nor by that company's subsidiaries. The Quincy, Mohawk, Wolverine, and all three Copper Range mines, Baltic, Trimountain, and Champion, are working full time and with full crews. Their copper output is not normal, but it has not been normal for more than a year. Quincy will show an increase in May over April, and there is no effort to decrease production at Mohawk, which is now making the best record of the mine's career. A comparatively limited number of the miners who were let out by the Calumet & Hecla and subsidiaries went to work at other mines in the district.

## Manganese and Silver in the Philipsburg, Montana, District

BUTTE CORRESPONDENCE

During the war the Philipsburg district came into considerable prominence through its production of manganese for use in steel manufacture, though it is now principally a silver producer. Thirty years or more ago the Philipsburg district was rich in silver, but when the price of the metal declined the district lost heavily in population and finally became a mere village. It remained in that position until this country entered the war and the Government called for the production of manganese. Then many mining men opened up aban-

doned properties, and after building modern plants the manganese was shipped East in large quantities. As soon as the production of manganese became unnecessary, a number of the mining men started to explore for silver, and some have been successful. When the boom in silver started, what is known as the Scratch Awl shaft was reopened. In a short crosscut a rich body of silver ore was found, and in a short time this body of ore was extended along the drift for a distance of 150 ft. The first carload was brought to the Washoe smeltery and showed high silver content. The Scratch Awl ground is a narrow strip about 1000 ft. long and is entirely surrounded by claims of the Granite Bi-Metallic Co. The new orebody is said to be exactly in the middle of the Scratch Awl ground, with well-defined walls and a fine line, so that the chances of litigation appear remote. The ore in large part is native silver. Several other properties are being opened up, and the Bi-Metallic is engaged in sinking two shafts to a depth of 1000 ft. each.

## March Exports of Mining Machinery

The exports of mining machinery from the United States during March, 1919, according to the Department of Commerce, were as follows:

| Countries | Oil-Well Machinery | All Other Mining Machinery |
|---|---|---|
| France | ..... | $70,770 |
| Norway | ..... | 19,503 |
| Spain | ..... | 13,687 |
| Sweden | $556 | ..... |
| England | ..... | 57,627 |
| Scotland | ..... | 40 |
| Canada | 7,300 | 110,109 |
| Costa Rica | ..... | 135 |
| Honduras | ..... | 2,661 |
| Nicaragua | ..... | 3,768 |
| Panama | 32,835 | ..... |
| Salvador | ..... | 1,574 |
| Mexico | 36,811 | 94,035 |
| Newfoundland and Labrador | ..... | 198 |
| Cuba | 17,730 | 14,421 |
| Argentina | 19,828 | 500 |
| Bolivia | ..... | 59,935 |
| Brazil | 478 | 8,434 |
| Chile | ..... | 63,536 |
| Colombia | 270 | 7,634 |
| British Guiana | 1,083 | ..... |
| French Guiana | ..... | 1,306 |
| Peru | 1,092 | 29,289 |
| Venezuela | 3,453 | 6,547 |
| Aden | 45 | ..... |
| Chosen | ..... | 17,087 |
| British India | 26,878 | 13,928 |
| Straits Settlements | ..... | 346 |
| Dutch East Indies | 181,896 | 78,731 |
| French East Indies | ..... | 4,233 |
| Hongkong | ..... | 540 |
| Japan | 32,320 | 44,833 |
| Russia in Asia | ..... | 4,355 |
| Australia | 1,040 | 14,830 |
| Philippine Islands | 48,615 | 3,813 |
| Belgian Kongo | ..... | 117,103 |
| British West Africa | ..... | 3,556 |
| British South Africa | ..... | 78,829 |
| Madagascar | 2,359 | ..... |
| Totals | $414,589 | $947,898 |

During February, 1919, the value of oil-well machinery exported totaled $398,041 and that of all other mining machinery was $1,070,717. March, 1918, exports were valued at $123,572 and $1,286,616, respectively.

## U. S. Patent Office Society

Employees of the U. S. Patent Office have organized, under the name of the Patent Office Society, for the purpose of advocating certain reforms in the administrative branches of the department, which, it is claimed, will bring about a higher efficiency in the system. Committees on legislation and publicity have been appointed with a view to educating the public to the necessity for an immediate improvement of the present Patent Office system and to further Congressional enactment to broaden the scope of the department. The plan includes the separation of the Patent Office from the Department of the Interior and provides for an executive officer who shall be an industrial and efficiency expert.

## Labor Conditions in Utah Mines

SALT LAKE CITY CORRESPONDENCE

The possibility of a strike in the Tintic district appears to be at an end. At a meeting held in Eureka, at which 1200 persons, miners and citizens of Eureka, were present, it was decided to put off indefinitely the taking of a "strike vote." Conditions are normal at this camp. At Park City the strike is still on, although a few men, chiefly Ontario Silver employees, have returned to work. The pumps at this property have been working throughout the period of strike, manned by old employees. It is expected that more men will follow the example of the Ontario Silver employees and return to their work.

Utah mine operators last March undertook an investigation into the cost of mine supplies and necessaries of life in this section, which are as high as they were last July, and in some cases higher. The continuance of high prices, with copper and lead at the present low level, makes an extremely precarious situation. In the effort to investigate causes and reduce the cost of supplies to themselves and the cost of living to their employees, a number of operators have circularized Salt Lake business men and dealers in the mining camps, inviting coöperation in finding a solution of the problem and forecasting a closing of the mines unless conditions improve. A blank is enclosed in the letter giving a list of commodities—flour, rice, sugar, butter, peas, string beans, tomatoes, eggs, ham, bacon, pork and beans, and other foodstuffs, asking for information regarding prices paid in 1915, 1918, and 1919. The letter reads in part:

"We have been unable to ascertain that those who furnish supplies and the necessaries of life to our employees are making efforts to reduce the cost of these commodities. Unless action along this line is taken at once, and substantial reductions are made, many more mining properties will close down in the near future. This would cause great distress to our men and their families and injury to the commercial and manufacturing industries of the state, as well as to the mining industry. We have determined to act in the matter ourselves rather than to remain acquiescent and see our own business crippled, with consequent bad effect on the state as a whole. Our preliminary inquiries disclose that the costs of supplies in Salt Lake and the mining camps are as high as they were last July. We purpose extending our inquiries as far as possible and taking such action as will serve our welfare and that of our employees. Your coöperation is invited to solve a situation, which if not corrected in the immediate future, will seriously injure our business as well as yours."

Those signing the letter are: Imer Pett, general manager Bingham Mines Co. and Eagle & Blue Bell Mining Co., chairman; C. E. Allen, manager of mines, U. S. Smelting Co.; C. F. Jennings, assistant purchasing agent, Utah Copper Co.; F. J. Wescott, secretary Silver King Coalition Mines Co., and J. B. Whitehill, purchasing agent, International Smelting Company.

# Editorials

## The Odds That Favor

THERE'S an old chairman of the board of an important bank in New York who is said to have graduated more bank presidents from among his clerks than any other man in America. One of his requirements (or preferences that are so strong as to amount almost to requirements) is that he does not want city boys. He wants young men who have been raised in the country, preferably on a farm, and he insists upon taking them when they are reasonably young. He is not particularly interested as to whether they have been through college or not. His point is that if they have grown up in the country they have developed mental resources to meet conditions as they arise—they do not need the flare of lights and the blare of bands for their leisure. In short, he wants young men who can sit down and think during their hours of ease, with a view to doing better for the bank, and thus better for themselves. He may be prejudiced about the evils of city life, but usually he cuts off the argument with the statement that "city boys know too much." Like all good bankers, he objects to clerks with bad habits, but he also objects to those who address themselves to building up a social reputation by dancing all night in addition to working by day.

Rich young men who have had all the so-called advantages are likely to be under a serious handicap in industry. They are not noted, as a class, for their contributions of hard work. Men engaged in research do not want them, fearing that they may be inclined to take a vacation as soon as they have become useful. Fathers often think that if their sons put on overalls they achieve wisdom thereby, and in their mother's eyes this amounts to nothing less than heroism; but unrelated persons usually want them only for their potentialities to "swing" capital.

It is the young man who must work, who must make a career for himself or meet the tragedy of failure, that is usually given preference when a job is to be filled. Men with the proper mental equipment and preparation, who have ambition within them and nothing on the side in the way of property, are towers of strength in research. They are full of invention and are unafraid of everything except failure. And they hardly believe in failure. We have seen splendid young fellows exploited in the most outrageous manner, to the breaking point and beyond, just because they were ambitious and had ginger to spare, and were resolved by the might of their youth to make a good career.

In nearly every large industrial establishment there are such men, with youth and enthusiasm and a vast capacity to do things, to think and to plan. They are of the kind who, if they were clerks at the old Fifth Avenue bank, would become bank presidents. But they dig and shovel coal and load and unload along with others who are feeble minded, and with older men whose thinking apparatus, such as they have, is already atrophied—men who can work only with their hands—and strike.

If these young men with Type-A minds could be picked out, and the vision of a successful career spread before them, they might achieve wonders. Each has his own way to make, and he has nothing to fall back on in case of failure—but he has very little light ahead.

All sorts of ways to pick out those marked for success are proposed, from judging them by the shape of their faces to sizing them up by the color of their hair and skin, but most of these methods smack of quackery. On the other hand, within the domain of applied psychology, there are tests that have proved remarkably successful in the Army. This is no field for the tyro, any more than it is for the phrenologist or the astrologer, or the fortune teller of any sort. It is a subject that is new—one that demands scholarship, real scholarship, with long academic study and earnest laboratory experiment back of it. We believe, however, that the time is approaching when it will be possible, by means of a few carefully prepared tests by the right examiners, to select the really gifted and capable young men.

Let us grant for the sake of argument that such tests are possible and practicable. Then suppose that in a body of 1500 workmen there should be fifteen, or even seven, young men of high mentality. Suppose these were set apart as cadets and offered special courses of study to equip them for positions of responsibility in the establishment. Their achievements might well be no less than astounding.

For graduate chemists and engineers, employers now have to take what they can find. Few are available, because of the cost of an education, and these are not all first-class material. But this fraction of 1% of exceptional and gifted men—the young fellows whom the dice of circumstance have shut out from opportunity—are working all unknown and with a mighty longing in their hearts. Under the plan mentioned, they would find the doors opened to them, and it seems reasonable to believe that, out of their pent-up desire to function in affairs, they would contribute ideas and inventions and better order, and help in a measure that cannot be purchased. It seems possible that the way of progress may lie along this line. It would be taking the long chance, but opportunity and the men are still too far apart.

## Fake Oil-Stock Promotion

THE sale of stock as a means of raising funds for the legitimate development of mineral discoveries is in danger of receiving a serious setback. There are times when mass psychology seems to affect individuals, ordinarily well balanced, to buy anything which is called stock, even although, when subjected to a merely cursory examination, its dubious character is obvious.

At present there is what amounts almost to a stampede to purchase so-called oil stocks. Hundreds of companies have been floated, and though many of these may have merit, there are also many which, making glittering promises and holding forth the inducement of close proximity to some producing company as an enticing bait to be taken by the "sucker," can present

only the prospect of a complete loss of the money paid for their stocks.

Between the substantial stock and the out-and-out "wild-cat" there is a twilight zone which requires more than ordinary skill and expert knowledge on the part of the investor in selecting the stock that has a gambler's chance of success. To distinguish between the legitimate enterprise and the "wild-cat" it is necessary to make a searching investigation of the affairs of the company offering its shares for sale. A concern that has a definite place of business, that can present a balance sheet on demand, and which is backed by men who are known for their respectability and technical knowledge of the business in which they are engaged, and possessing connections with a bank of known standing, is at least entitled to more consideration than a company which is obviously engaged only in stock selling. Many of the latter companies, it is true, make a pretense of respectability as well as a pretense of drilling a well, but how many can stand a thorough examination by a recognized and trustworthy authority? How many take the precaution of having a competent geologist pass on the oil possibilities of their land? How many give out any real information in their prospectuses?

To say that a thorough investigation should be made by the intending purchaser is easy enough, but not many casual stock buyers are able to make such an investigation. They are admonished to "Sign here! Pay here! Hurry! Hurry! The stock is advancing." By a play upon the credulity and the greed of the individual the transaction is consummated and the money lost before the victim awakes to the fact that the purchase of stock can be made like the purchase of any worth-while thing.

*Caveat emptor!* is a simple thing to say, but we cannot dismiss the subject so easily. It is a matter of concern to every one who has the interests of the mining industry at heart. Every individual who is swindled in the present instance means some one who will for a long time look upon the whole field of legitimate investment in mining in much the same light as he looks upon his own unfortunate investment. It is true that, for the most part, the victims are men of small means, but in the aggregate their investable funds are worth conserving to a better purpose.

If for no other reason than for the honor of their industry, mining engineers and mining men should cooperate to seek every reasonable avenue to clean the "wild-catters" and "fly-by-nights" out of the stock-selling business. It is the duty of the New York District Attorney's Office to initiate active steps to keep these gentry from continuing. At present that office appears to be in a state of apathy. The proddings of the New York *Sun* and the *Tribune* will, we hope, have some effect. Both of these journals are to be commended for their efforts. The situation is, however, not entirely local. It is spread over much of the United States, and has reached into the small cities and villages. It is a condition that plainly demands the attention of the Federal authorities.

There was a time when the U. S. Postal service went hot foot after the sly gentry who use the mails to defraud. We hear little of that now. We do not know how many postal inspectors are engaged upon the business of hunting out mining frauds, nor do we know how many investigators the Federal Department of Justice has in the field, but concerted effort on the part of these departments, together with the coöperation of both the Bureau of Mines and the Geological Survey, is urgently needed.

Attempts will be made to bring a Federal "blue-sky law" before the present Congress, but, by the time the law is passed, and its machinery started, the hard- and the easy-earned savings of many good people, as well as an indeterminate but large sum in Liberty Bonds, will have disappeared into the pockets of an all too numerous class that preys upon the community. Only prompt and vigorous action under the laws, both state and Federal, that are now operative will prove effective in meeting the present situation.

## Engineering a Flight

ADMIRAL PEARY methodically planned his attack upon the North Pole. Experimentally he tried out his conclusions. He carefully selected his companions, and inured both them and himself to the hardships of arctic travel. The food and transportation problems were fully worked out. In the light of the careful and thorough preparatory work the result was a foregone conclusion. Shackleton and Amundsen also won by similar methods.

The flying men of the Navy set their goal upon the other side of the Atlantic. They also took up their task in much the same way as the naval constructor undertakes the design of a battleship. The flight problem had many ramifications, but the two most important were the men and the machine. Both were developed, the one by preliminary training upon the smaller hydroplanes and the other out of the experience gained in the progressive design and building of larger and larger planes. The plane which was finally developed, the NC class, represents the combined efforts of many engineers and the experience of many flyers. A few of the characteristics of the plane are worth comment.

The weight of the plane without load is 15,100 lb.; and, with its maximum load, 28,200 lb.; the weight of gasoline, oil, men, and provisions being 13,100 lb. The weight of the plane is 53.5% of the combined weight of plane and load. To appreciate this better, the weight of a steel ore car of 50 tons' carrying capacity is about 24% of the combined weight of load and car. The plane carries 0.86 of its unloaded weight, the ore car 3 times its own weight. In other words the plane requires 3.5 times as much material in its construction for an equivalent carrying weight.

A steel ore car does not receive gentle treatment over the roadbeds and at the speeds that are reached in modern traffic, but the strains which it must meet are proportionally less than for the plane traveling at a speed of 80 knots. Nevertheless the plane is not subjected to the shocks, except at landing, that the ore car must meet. The large surplus of material as compared with the ore car on the basis of weight-carrying capacity is undoubtedly required on account of the peculiar conditions under which the plane must operate. The comparison becomes less striking when we consider that the plane must carry its own motive power, whereas the car is only a containing vessel.

The total area of the wings, banking planes, stabilizers and rudders is 2981.6 sq.ft. The weight when fully loaded is 9.45 lb. per sq.ft. of surface; and when gasoline and oil are exhausted the weight is 5.46 lb. per sq.ft. The aggregate power of the four motors is given as 1600 hp. or an equivalent of 0.536 hp. per

sq.ft. of surface. The fully loaded weight is equivalent to 17.62 lb. per hp., and the weight, less gasoline and oil, is 10.2 lb. per hp. Thus the plane at the end of its flight has much less weight to sustain and greater power per unit of weight. It is perhaps not difficult to see why planes of this size have considerable difficulty in rising at the beginning of a long flight.

At the beginning of the flight, of the total weight the machine itself made up 53.5, the gasoline 39, the oil 3.2, and the men and supplies 4.2%. At the end of the flight, when the gasoline and oil are exhausted, the machine constitutes 92.6 and the men and supplies 7.4% of the total weight. Thus the plane is somewhat similar to the man who packs his grub upon his back on a long trip. Each day makes the load lighter. The plane, however, lightens its load at the rate of over 700 lb. per hour of flight. The man on foot lightens his pack at the rate of 4 lb. per day. His limit of travel is confined to about 10 days; the flight limit of the plane is somewhat less than a day, unless fuel and oil are replenished.

The arrangements of the flight and its execution require no repetition here. It is sufficient to say that the whole project was carried out in a way that sustains the excellent reputation of our Navy men.

## Goethals Awarded John Fritz Medal

PRAISE and high honors have been accorded General George W. Goethals since the completion of the Panama Canal, and he has enjoyed in exceptional degree the esteem and confidence of the American public, and is secure in his reputation in foreign countries, but the recent award of the John Fritz Medal records professional recognition of a great professional achievement. In honoring the General, engineers conferred honor on themselves and on their profession.

General Goethals possesses in an unusual degree that which all engineers recognize as being necessary to the achievement of success—character. Another distinguishing attribute of Goethals is his steadfastness of purpose. This was strikingly illustrated when the landslide occurred at Culebra in 1915, necessitating the closing of the waterway. General Goethals immediately changed his plans for leaving his post, assumed the full responsibility of repairing the damage, remained in Panama, and completed the big job.

The Panama Canal is a monument to the confidence, courage, and patience of a man whose merit equals his reputation.

## Roadbuilding in Mining Districts

TRANSPORTATION is one of the most important problems with which the mining industry has to contend. The advent of the motor truck brought the far-off district nearer the main traffic lines, but it also brought into prominence the vital necessity of good road construction as a necessary condition for the operation of motor trucks. Mining interests in the different states should combine to bring the needs of the individual mining districts in the matter of new roads and the improvement of old roads to the attention of the road departments of the various states. It is estimated that the expenditures for highway work during the current year will amount to $500,000,000. A considerable proportion of this sum ought to be expended in increasing the accessibility of our mining districts, particularly those which have been neglected by the railroads. Only by concerted action can the miners hope to secure a fair apportionment of this sum and a recognition of the fact that the industry they represent deserves consideration in the matter of improved transportation facilities.

## BY THE WAY

"Come 'ere, m'son," said Cap'n Dick, "I wants to show thee sumthin'. W'ot's think on this 'ere stope? Neat, isn't un? An, dam-me, thee'll fin' un that way mos' o' tha time. An', min' you, these chaps 'oo's workin' 'ere on this contrac' is doin' 'andsome. 'Ere's tha tool box, locked h'up as nice as you please; see they bloody 'eadpoles in tha back; timber wedged h'up—h'evrything as tidy as can be an' as 'andy as a pocket in a shirt. Two o' they chaps 'oo works 'ere is 'eaded for shif' boss jobs, an' t'other figgers as 'ow 'e's gawin' to one o' these colleges come next fall. Dam-me, do my 'eart good to see they young chaps gettin' on, for I tell'e, m'son, with h'all this 'ere h'improved machinery an' such, man mus' 'ump 'imself to keep gawin'. Back long we, w'en I started, we 'ad nothin' but single- an' double-jackin' an' a bloody lot o' mules to drag h'out cars to tha shaf'. An' naow if thee doesn't 'ave h'air drills an' these 'ere h'electric motors, thee's got no mine, jus' a ole' in tha groun,' m'son." D. E. A. C.

Every mining region where fortunes have been made or are in the making constitutes a favorable zone for what might be called "secondary enrichment of romantic literature"; yet even if some of the stories lack positive confirmation they offer a means of spurring the imagination of youthful adventurers who will be the important mining men of future years. Africa teems with little yarns that seldom get into print; though some have been published in spite of the proverbial taciturnity of Britons. In the *South African Mining Journal* of Mar. 18, 1911, it is related that a character lovingly spoken of as "Old Hartley" once had the good fortune to shoot a large bull elephant. As the giant pachyderm writhed about in dying agony, the tusks turned up considerable ground. Hartley became interested in the appearance of the soil and panned some of it. He found that it was worth while, and that discovery marked the beginning of a goldfield. Youth should remember the advice of a fabled colored preacher in connection with a dissimilar incident in one of his sermons, which may be paraphrased as "De good Lord ain't gwine to furnish an elephant fo' ebery prospector." But listen! The natives of Africa tell of a fearsome monster, half elephant and half dragon, that is said to inhabit the vast swamps of Northern Rhodesia. From the descriptions, it seems to fit palæontologists' idea of the brontosaurus. A traveler named Menges is credited with fixing the habitat of the beast as being near the headwaters of the Lunga and Kafue rivers. Carl Hagenbeck, the famed animal collector, not only believed the tales but sent an expedition to secure a specimen, dead or alive. The hunt failed, owing to fevers and attacks by hostile natives. Hagenbeck, in his book "Beasts and Men," stated that he hoped yet to prove that the animal exists. If it does, there is still a chance for the fellow who likes sport but is too lazy to dig.

## Personals

**C. A. Heberlein**, of Nacozari, Mexico, expects to be in New York until June 1.

**D. W. Shanks** is now manager of the Rio Plata Mining Co. property near Guazapares, Chihuahua, Mexico.

**Marion L. Thomas** is in Cherry Creek, Nev., and is not expected in New York until the latter part of June.

**H. C. Carlisle** of The Pas, Manitoba, expects to be in New York City at the Buckingham Hotel until about June 10.

**D. H. Forbes**, manager of the Teck Hughes Mine, Kirkland Lake, is in the Wellsey Hospital, Toronto, recovering from an attack of pneumonia.

**T. J. Harwood**, formerly of the LaRose mine, Cobalt, was in Toronto to attend the trial of the O'Brien mines vs. the LaRose mines.

**John H. Banks & Son**, formerly at 61 Broadway and 10 Old Slip, have removed their office and laboratories to 16 John Street.

**Donald F. Irvin**, mining and metallurgical engineer, writes from Antofagasta, Chile, on May 1 that at the present time he will be on a trip into Bolivia and Peru.

**C. E. Addams**, former manager of the Ray Hercules, now is in west Texas, representing a group of Arizona men in oil investments.

**H. H. Stout** has resumed his former position as superintendent of the Copper Queen smeltery at Douglas, Ariz., after serving with the engineers in France, with the rank of lieutenant colonel.

**W. H. Miller**, president of the Rio Plata Mining Co., and **A. Nesbett** have returned to New York after a visit to the company's property at Guazapares, Chihuahua, Mexico.

**H. W. Kitson** is making a geological survey for the Iron Cap Copper Co. at Globe, Ariz., in connection with the Apex litigation between this company and the Arizona Commercial Mining Co., which also involves water rights.

**E. O. Daue** expected to sail on May 28 for Brazil, accompanied by **John Boyd** and **Charles S. Margon**. He plans to go up the Amazon into Bolivia and will be gone about four months.

**Lieut. Bernard H. Lasky** has returned from service abroad with the 316th Engineers, A. E. F., and has resumed his former association with Mowry Bates, petroleum and mining geologist, Tulsa, Okla.

**D. C. Williams**, of the Western Exploration Co., is in Kingman, Arizona, making preliminary arrangements to unwater the Flores mine, in the Cerbat Range, Mohave County, Arizona.

**Capt. G. R. De Beque**, on the staff of the Chief Engineer, 2nd Army, A. E. F., formerly of Guanajuato, Mexico, has returned to the United States after 20 months' service in France. He will reëstablish himself in mining engineering.

**F. Julius Fohs**, oil geologist, of New York and Tulsa, expected to sail on May 29, for London. He will be gone for three months, having been designated by the Zionist Organization of America, together with assistants, to make scientific investigations in Palestine. The work will be non-commercial in character.

**John D. Ryan, Cornelius F. Kelley**, and **Benjamin B. Thayer** were re-elected directors of the Anaconda Copper Mining Co. at the annual meeting of stockholders in Butte, Mont., on May 21. Mr. Ryan and Mr. Thayer made an inspection of the Anaconda properties during the week.

**Professors Lambert and Carlson**, of the Minnesota School of Mines, are heading the sophomore class of the school during their annual six weeks of practical work. They are at present at the Scranton mine, in Hibbing, studying the underground layout.

**C. O. Ellingwood**, of the Western Exploration Co., is in the Middle West financing the Los Prietos Quicksilver Mines Co., recently incorporated under the laws of the State of California. This quicksilver property is in the Montecito mining district, Santa Barbara County, California.

**Clement K. Quinn** and associates, of Duluth, have purchased from the Jones & Laughlin interests the Rolling Mill mine, at Negaunee, Mich. The Rolling Mill shipped 250,000 tons during 1916 and has a capacity of 300,000 tons. It was idle during 1917 and 1918.

**F. M. Townsend, H. N. Waller, D. C. Williams, C. O. Ellingwood**, and **H. W. Moore**, all of Los Angeles, Calif., have formed an association under the firm name of the Western Exploration Co., with offices at 910 Higgins Bldg., Los Angeles. C. O. Ellingwood is secretary and financial agent of the company, and H. W. Moore is the engineer.

**S. B. Eaton** of Dover, N. J., registered at the New York office of the American Institute of Mining and Metallurgical Engineers during the month. Other registrants were: **E. O. Daue**, Philadelphia; **Jay P. Wood**, New York; **Sherman Eaton**, Smithport, N. C.; **H. Foster Bain**, Washington, D. C.; **S. B. Patterson**, Allentown, Penn.; **A. B. Hardie**, Philadelphia; **E. Fleming L'Engle**, Joplin, Mo.; **Rudolph Gahl**, Denver; **C. Vey Holman**, Maine, and **Henry A. Tobelmann**, Ajo, Arizona.

**Judge E. H. Gary**, chairman of the U. S. Steel Corporation, and other officials of the corporation, accompanied by **G. G. Crawford**, president of the Tennessee Coal, Iron & R.R. Co., visited Mobile, Ala., on May 15. The day was spent in inspecting the plant of the Chickasaw Shipbuilding Co., subsidiary of the Tennessee company, where four 9600-ton ships are under construction. Judge Gary and party spent the 16th in Birmingham, visiting some of the various plants of the Tennessee company.

## Obituary

**Leighton Stewart** died of pneumonia on May 21 in San Francisco. Mr. Stewart was a mining engineer with offices at 42 Broadway, New York, and during the war served with the Canadian engineers.

## Societies

**Duluth Engineers' Club** held the regular meeting May 19 and enjoyed a lecture and a moving picture detailing the electrification of the Chicago, Milwaukee & St. Paul R.R. W. H. Hoyt, delegate of the club to engineers' conference recently held in Chicago, reported on the proceedings of the conference.

**The Mining and Metallurgical Society of America**, New York Section, will hold a meeting at the Columbia University Club, 4 West 43rd St., on June 5. The subject of discussion will be "Economic Aspects of the Labor Situation." Clinton H. Crane, president of the St. Joseph Lead Co., and Walter R. Ingalls will speak, and continuation of the spirited discussion of the last meeting is desired. Dinner will be served promptly at 7 p.m.

**Engineers' Club of Northern Minnesota** held the final meeting before the summer adjournment at Eveleth on May 24. H. H. Hindshaw, who is in charge of the experiments being conducted by the state with regard to huge peat reserves of Minnesota, read an interesting paper on that subject. Details were completed for the entertainment of the national convention of the American Society of Engineers which will adjourn from Minneapolis to the Mesabi range on June 20.

**Engineers' Society of Western Pennsylvania** held a joint meeting with the Pittsburgh Section, Heat Treaters' Research Society, on May 20. The subject of the paper presented was "Notes on Heat Treatment of Steel," by T. D. Lynch, research engineer of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn. The paper was illustrated by lantern slides. On June 7 an inspection trip through the plants of the Republic Iron and Steel Co., at Youngstown, will be made.

**American Institute of Electrical Engineers** elected Calvert Townley president at the annual business meeting held on May 16, in New York City. Mr. Townley is assistant to the president of the Westinghouse Electric and Manufacturing Co. He was born Oct. 18, 1864, in Cincinnati, Ohio, and was graduated from the Sheffield Scientific School in 1886, afterward taking a mechanical engineer's degree in 1888. He has been connected with the New York, New Haven & Hartford R.R. as vice-president in charge of electrification out of New York, subsequently becoming first vice-president of the Consolidated Railway Co. (afterward the Connecticut Co.), president of the Lackawanna & Wyoming Valley R.R. Co., and vice-president of the Niagara, Lockport & Ontario Power Co.

## Industrial News

**Standard Electric and Elevator Co., of Baltimore**, has secured the services as sales manager of M. H. Jones, who has been connected with the Westinghouse Electric and Manufacturing Co. for the last 15 years as assistant to the manager of Philadelphia district.

**The Metal & Thermit Corporation**, New York, has issued a folder entitled "How Thermit Healed My Broken Jaw," which illustrates the operations involved in making a thermit weld on the 13½-ton broken upper jaw of an alligator shear used by Joseph Joseph & Bros. Co., Modens, Penn. The break welded was 80 in. in length and varied from 4½ to 23 in. in thickness.

**American Spiral Pipe Works**, Chicago, has recently issued a "Production Book" containing many photographic reproductions of various lines of manufacture. The announcement states that this book is particularly interesting from an engineering and industrial standpoint and clearly illustrates the advancement in the manufacture of corrugated steel furnaces, large-diameter lap-welded steel pipe, spiral riveted pipe, forged-steel flanges and forged-steel boiler nozzles. Copy of this book will be mailed upon request.

**The Allied Machinery Company of America** has increased its capital stock to $5,000,000. This was made necessary by the decision of the American International Corporation to group all of its machinery export selling subsidiaries under one head. This move has in view the complete absorption of the Allied Construction Machinery Corporation by the Allied Machinery Company of America. The Allied Machinery Company de France and the Allied Machinery Company d'Italia will retain their corporate entities, but their parent corporation will be the Allied Machinery Company of America, rather than the American International Corporation, as before. This is also true of the Horne Company, Ltd., of Japan, which was purchased early in the year by the American International Corporation. All shares of the Allied Machinery Company of America will, as before, be owned by the American International Corporation.

The Allied Machinery Company of America was formed in 1911 by interests associated with the National City Bank of New York, to sell machine tools in Europe. In 1916 it was taken over by the American International Corporation, which immediately set about to expand and organize the business on a large scale. The business has increased rapidly, and today the company is operating in 14 countries. J. W. Hook will continue as president of the Allied Machinery Company of America, in general charge of the business. F. A. Monroe, S. T. Henry, and T. G. Nee have been elected vice-presidents. Mr. Monroe is in charge of the administrative affairs of the company, Mr. Henry in charge of sales and advertising, and Mr. Nee is at present in Japan devoting his attention to the affairs of the Horne Company, Ltd. R. P. Redier is general sales manager, with headquarters at Paris.

## Trade Catalogs

**Mineral Collection.** G. S. Scott, 20 Nassau St., New York City, has issued pamphlet descriptive of a low-cost mineral collection, comprising 115 specimens, all the important ores being represented. This collection is designed to meet the need of the mining engineer or of anyone desiring a cabinet mineral collection.

**Fans, Blowers, and Exhausters.**, Buffalo Forge Co., Buffalo, N. Y. Section 400; 5 x 8; 34 pp.; illustrated. Describes the design and structural details of "Buffalo" fans, blowers, and exhausters. Included among the types are experimental blowers, pressure blowers, volume blowers and exhausters, gas and acid fume exhausters, standard mill exhausters, and double standard reversible mill exhausters. A description of miniature conoidal, electric disk, and pulley propellor fans, slide pattern blast gates, and dust and refuse collectors is also included.

**Concentrating Machinery and Equipment.** Allis-Chalmers Manufacturing Co. Milwaukee, Wis. Catlog 107; 8 x 10½; 112 pp.; illustrated. The bulletin is intended to describe as far as possible the latest types

and designs of machinery to meet the demands of modern practice. Most attention is given to those machines which are recognized as standard and which have shown the greatest progress. The catalog is well illustrated and is of interest to mining and metallurgical men, as it contains flow sheets, plans, and photos of recent installations of well-known mining companies. The treatment of a large variety of ores is described and a number of valuable tables of technical data are included.

**"C-H Electric Soldering Irons and Hand Tools,"** Cutler-Hammer Mfg. Co. Milwaukee, Wis. Folder, 8 pp.; 3½ x 6. Illustrates and describes standard sizes of electric hand-soldering irons and calls attention to an automatic soldering iron rack and a new C-H soldering fixture. The automatic rack is a small, complete switchboard, which may be mounted on the wall or a machine within convenient reach of the workman, and provides a definite place for the iron when not in use. It automatically prevents overheating of a soldering iron, prolongs its life, and increases the working value of the iron. The new soldering fixture, which was illustrated and described in a previous issue of the "Journal," facilitates certain soldering operations where the manufacturing processes permit bringing the object to be soldered to the iron. The pamphlet also makes mention of the C-H current regulator, and the C-H Seventy Fifty Switch, which may be installed on the cord of any soldering iron and permits easy current control. Prices, dimensions, and other data are included.

**Remco Redwood Pipe.** Redwood Manufacturers' Co., Hobart Bldg., San Francisco; 6 x 9; 116 pp.; illustrated. Catalog IX, replete with information both in general and tabulated data for accurate calculations on the use of wood pipe as a closed conduit for conveying water. The introduction is an interesting history of the development of this product, from the primitive efforts of burning a hole in a straight log to the present modern steel-banded wood stave pipe as used by 49 cities for water supply and by the U. S. Government, which received since 1917 2,311,797 lineal feet of Remco pipe, 4 in. to 48 in. diameter, for use in 73 Army camps and of which 169,000 ft. was shipped to France.

The three types of pipe, continuous stave, machine banded, and bored, and the quality of timber used, with a description of pipe fittings, are described in the first pages. The principal uses of wood pipe, including main supply lines, power plants, irrigation systems, mine drainage, hydraulicking and sluicing, and sewage disposal, are discussed, giving, in many cases, the location of installations.

The last half of the catalog contains an unusual number of tables, the principal ones dealing with friction loss in small pipe, shipping weights in lb. per lineal foot, approximate freight-car capacity, maximum allowable curvature, pressure allowance in design, water-wheel tables, power and speed for direct-driven centrifugal pumps, and pressure conversion. Definitions of hydraulic engineering terms and methods of calculation of flow are also presented. The table of contents is arranged alphabetically, which makes the catalog a valuable source of reference of technical data.

## New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

**Air Lift**—Apparatus for Elevating Fluids by Compressed Air. Herbert T. Abrams, Orange, N. J., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,302,268; Apr. 29, 1919.)

**Alloy Steel,** Process of Making. Alan Kissock, Tucson, Ariz. (U. S. No. 1,300,279; Apr. 15, 1919.)

**Alum**—Process of Preparing Iron-free Alum. Frederick Laist, Frederick F. Frick and Robert S. Oliver, Anaconda, Mont., assignors to Anaconda Copper Mining Co., Anaconda, Mont. (U. S. No. 1,300,418; Apr. 15, 1919.)

**Alumina**—Process of Preparing Alumina. Frederick Laist, Frederick F. Frick and Robert S. Oliver, Anaconda, Mont., assignors to Anaconda Copper Mining Co., Anaconda, Mont. (U. S. No. 1,300,417; Apr. 15, 1919.)

**Alunite**—Process of Treating Alunite. Roy Cross, Kansas City, Mo., assignor to F. H. Thwing, Kansas City, Mo. (U. S. No. 1,301,394; Apr. 22, 1919.)

**Bessemer Converter.** Albert Rommelaere, South Vancouver, B. C. (U. S. No. 1,299,034; Apr. 1, 1919.)

**Silver-Ore Treatment**—Process for Extracting Silver from Ore Containing Manganese Dioxide. Martinus H. Caron, Weltevreden, Java, D. E. I., assignor to Research Corporation, New York, N. Y. (U. S. No. 1,298,454; Mar. 25, 1919.)

**Sintering Ignition Process.** Charles W. Adams, Jr., Murray, Utah, assignor to American Smelting and Refining Co. (U. S. No. 1,299,892; Apr. 8, 1919.)

**Steel**—Process of Heat Treatment of Steel. Federico Giolitti, Turin, Italy, assignor to Societa Anonima Italiana Gio. Ansaldo & C., Genoa, Italy. (U. S. No. 1,296,649; Mar. 11, 1919.)

**Thickening and Separating Solids from Liquids,** Apparatus for. John A. Traylor, Salt Lake City, Utah. (U. S. No. 1,299,872; Apr. 8, 1919.)

**Tungsten**—Metal and Its Manufacture. Aladar Pacz, Cleveland, Ohio, assignor to General Electric Company. (U. S. No. 1,299,017; Apr. 1, 1919.)

**White Lead**—Process of Manufacturing Certain Lead Products. William P. Thompson, Liverpool, England. (U. S. No. 1,297,934; Mar. 18, 1919.)

**Zinc**—Electrolytic Refining of Metallic Zinc-Bearing Materials. Charles H. Aldrich and John K. Bryan, Baltimore, Md., assignors to Electrolytic Zinc Co., Inc., New York, N. Y. (U. S. No. 1,299,414; Apr. 8, 1919.)

**Zinc**—Method of Producing Blue Powder. Frederick F. Farnham, Fairooks, Penn., assignor to National Metal Molding Co., Pittsburgh, Penn. (U. S. No. 1,299,445; Apr. 8, 1919.)

**Zinc**—Method of Refining Volatile Metals. Sven Huldt, Stockholm, Sweden. (U. S. No. 1,298,722; Apr. 1, 1919.)

**Zinc Kettle.** John G. Granberg, Beckemeyer, Ill. (U. S. No. 1,298,692; Apr. 1, 1919.)

# Editorial Correspondence

### SAN FRANCISCO—May 21

**The Rate of Assessment** levied to support the work of supervision of drilling operations in California oil fields so as to prevent damage to the fields by water or other causes is based upon the amounts of oil and gas produced in the proved oil land. The rate for the coming year amounts to $.001076 per bbl. of oil, or 10,000 cu.ft. of gas produced, and $0.137 per acre of proved oil land. The amount to be collected is $123,000, about $6000 less than the total assessment for last year.

**Mammoth Smeltery** of the United States Smelting, Refining and Mining Co. at Kennett, Shasta County, Calif., shut down for an indefinite period on May 15, 1919, after what was evidently a serious attempt on the part of the officials of the company to continue operations, even though doing so at a loss. The direct cause of the shutdown was the refusal of a small percentage of the employees to work under the reduction of 50c. a day, made by the company in February of this year. No attempt was made to get strike breakers and employ guards to continue operations, although ordinary employment agencies were used in trying to fill the places made vacant by the men who quit. These men were mechanics employed at the smeltery and included the machinists, boilermakers, and train crews, in all 36 workmen.

**Comstock Northend Production** for the first half of May and including last three days in April totaled approximately $40,000, or an average of $13,300 per week. The total for the complete month of April, as shown by bullion shipments from the Mexican mill, was $62,000, an average of $15,500 a week. The ore comes from Consolidated Virginia and Ophir, and in May the average per-ton value as shown by the mill returns varied from $23 to $26 in Consolidated Virginia and $19 to $30 in Ophir. A feature of the first weekly report in May was the record of mine-car samples of Consolidated Virginia ore running $60.88 to $2788.20; other cars sampled $1000 a ton. These figures, of course, are exceptional, but the ore holds up to high milling return.

**The New Richfield Oil Field** in Orange County has already given encouraging results through the operation of the Union Oil Co. on the Chapman lease and the Standard Oil Co. on the Kraemer lease. A revised map showing development in the Richfield field to Apr. 15, 1919, is now ready for distribution. This area is included in State Mining Bureau Map 4, of the Whittier Fullerton fields, which also includes Olinda, Brae Canyon, Puenta Hills, and East Coyote fields. State Mining Bureau Map 5, of Whittier Fullerton fields, including Whittier, West Coyote, and Montebello fields, is also revised to Apr. 15, 1919, and on sale. It should be noted that the area of development in Orange County adjoining the town of Richfield has been officially designated as the Richfield field. There has been some confusion over the use of the name "Kraemer," because of certain "wild-cat" operations under a similar name in San Bernardino County.

**U. S. Bureau of Mines Has Withdrawn** from the conjunction work with the mines division of the California State Industrial Accident Commission. Mine inspection will now be conducted solely by the state. During the joint conduct of the mines division by the Bureau of Mines and the Industrial Accident Commission the work has been so well organized and the division is so firmly established that the aid of the Bureau of Mines is not really essential. But the entire work of mine safety and inspection should have been placed in the State Mining Bureau in the beginning. The data collected by the mine inspectors are largely duplicated by field assistants of the State Mining Bureau. Not only is the cost of gathering these data thus unnecessarily increased, but the placing of records in two distinctly separate bureaus is an inconvenience and annoyance to mining men. In fact, the mining public has but small knowledge of how much or how little of such records are available for public inspection. Both these departments are of great value to the mining industry, and their value could be largely enhanced if they were placed together under a competent director with the aid of trained assistants.

### BUTTE, MONT.—May 24

**No Mooney Protest Strike** will be called by the engineers' union, the chief labor organization in the Butte district. The question was decided by a three to one vote on a proposal to join in a country-wide demonstration on July 4, to last for four days. The action of the engineers decided the issue as far as Butte is concerned. The machinists' union voted to have nothing to do with the movement. Electricians voted to strike four days, but unless the engineers supported them their action is without effect.

**Anaconda Copper Mining Co.** is apparently indisposed to increased production, particularly of copper ore, until the metal surplus shows marked reduction. However, this corporation is increasing somewhat its development program and placing its properties in position to take full advantage of any improvement in metal conditions. During the lull in operation the company is fireproofing shafts and stations and doing improvement work which was impossible to accomplish during the war,

when the government was calling for a maximum copper output.

The large orebody on the 500 level of the Orphan Girl continues, with a heavy tonnage of silver-zinc-lead milling ore indicated. Shoot shows width of 35 ft. where intersected by crosscut, and this width appears to be maintained. Anaconda has purchased a half interest in the Kit Carson claim, to the west of the Orphan Girl, carrying the extension of the fissure.

It is probable the company will do further prospecting for Star West silver shoot. Operations at Bonanza have been abandoned after unsuccessful effort to discover this deposit on 500 level. The silver ore development at Alice property is progressing favorably.

Annual meeting of stockholders of the Anaconda Copper Mining Co. was held at the company's office at Anaconda, Mont., and the following directors were reëlected: John D. Ryan, Cornelius F. Kelley, and Benjamin B. Thayer. The report of Mr. Ryan as chairman of the board of directors, for the year ending Dec. 31, was adopted, and contributions of $50,000 to the Red Cross and the United War Funds Corporation, made by the officers of the company, were approved. Mr. Ryan and Mr. Thayer arrived here during the week for an inspection of the Anaconda's properties. Sentiment is pronounced that improvements in the copper metal situation are impending.

### WALLACE, IDAHO—May 22

**Vocational Training of Miners** as adopted in the two mines of the Coeur d'Alene district has been strongly approved and commended by Ben W. Johnson, of San Francisco, Federal agent for industrial education representing the Federal Board of Vocational Training. In company with Francis A. Thomson, dean of the Idaho School of Mines, Mr. Johnson made a thorough inspection of the work of the classes in the Morning and Hecla mines, after which he expressed satisfaction with the results achieved and predicted that the system would eventually be extended to all other metal-mining districts of the West.

**Control of the Ray Jefferson Mining Co.** was taken over a few years ago by Eugene R. Day, representing the Day Brothers. A mill of 400-ton capacity was built and a tramway constructed to the upper workings, and with a showing of tonnage available the O.-W. R. & N. company was induced to build a 10-mile branch up Beaver Creek to the Ray-Jefferson mill. It was soon demonstrated, however, that there was not sufficient ore in the upper levels to keep the mill running profitably, whereupon a deep crosscut was started to cut the vein about 1000 ft. below the upper workings. After cutting one vein, which proved barren, work was suspended, many months ago, on account of war conditions, with about 500 ft. remaining to be run to reach the main Ray-Jefferson vein. At the annual meeting of stockholders of the company on May 19 a board of directors was elected, and one of the acts of the board was to levy an assessment of 12c. per share, payable quarterly in installments of 3c. per share. The company has 2,000,000 shares, all issued, and if all the assessments are paid the treasury will be enriched to the extent of $240,000. The assessment is a severe jolt to many stockholders, who have confidently looked forward not only to the reimbursement of the Days through ore shipments, but to receiving dividends on their holdings.

**The Labor Situation** continues to be a serious problem for the operators of the Coeur d'Alene district. On Mar. 16, owing to the continued high cost of mining and the unsatisfactory condition of the metal market, which made it practically impossible to sell their product, the operators reduced wages of underground men from the war rate of $5.25 per day to $4.25. This action was reluctantly taken by the companies, for it was realized that the cost of living had not come down and that reduced wages would work a hardship upon their employees. And so it did, and also upon the mining companies themselves. Many single men drew their time and left the district, and better wages on the farms and in the lumber woods made it impossible to fill their places with new men. At the same time employees with families found the pay check unequal to the cost of actual necessities, to say nothing of a little surplus. To meet this situation, the operators met on May 19 and unanimously agreed to advance wages 50c. per day, making the rate $4.75, effective on May 20. Explaining this action, a statement was issued to the effect that the cost of living had not dropped, as the operators had anticipated when the reduction was made, which placed a heavy burden upon married employees in particular; that though there was no material change for the better in the lead market, there had been a sharp advance in the price of silver, and that it had been decided to give the employees the benefit of the rise, although it was stated that the additional profit of some of the companies was not equal to the wage increase. It is expected that the higher wages will result in relieving the labor shortage to a considerable extent.

### ISHPEMING, MICH.—May 22

**The Iron-Ore Movement From Marquette Range Mines**, which started slowly following the opening of navigation, is gaining ground every day, according to railroad men. Several additional crews have been put to work in the yards the last few days, and some additional steam shovels have been put in operation. Shipments are not as heavy from either the Marquette or the Menominee range as they were a year ago. A considerable part of the ore going from here is being shipped from pockets, although inroads are being made in several of the stockpiles. Local mining men look for a busy season.

### DULUTH, MINN.—May 24

**The Oliver Iron Mining Co.** is planning an extensive stripping campaign throughout the 1919 season, involving the removal of at least 10,000,000 cu.yd. of overburden. Among the properties to be worked are: Spruce-Leonidas, Eveleth, 4,000,000 yd.; Missabe Mountain, Virginia, 2,000,000 yd.; Canisteo, Coleraine, 2,000,000 yd.; Hull-Rust, Hibbing, 2,000,000 yd.

**Independent Operators** are a feature of this year's shipping season. Among the new shippers from the western district are the Pickands-Mather Co., the John A. Savage Co., and the Wisconsin Steel Co., shipping from the Danube, the Draper and the Sargent, respectively. The two former are equipped with washing plants; the latter is making direct shipments so far. The Cleveland-Cliffs Iron Co. is engaged in an elaborate exploration campaign on lands recently leased from the Great Northern Ore Lands corporation.

### AJO, ARIZ.—May 24

**About Twelve Days' Production** will have to be subtracted from the New Cornelia's output for May, owing to a fire in the main pump pit, because of a short-circuit of the pump motor. Helmet men brought from Bisbee helped extinguish the blaze and to repair damage caused by the destruction of 146 ft. of shaft timbering. In the meantime water for the camp had to be brought in by tank cars from Gila Bend, 42 miles distant, and leaching operations were necessarily suspended.

Most of the machinery for the new flotation mill is on the ground. Careful experiments will be continued over a term of months before absolute determination is made of the type of mill of 5000 tons' daily capacity, that will be installed for the reduction of the sulphides now under development beneath the carbonates and on the acquired Ajo Consolidated ground. Shovels are cutting out a new gloryhole south of the old one, and preparations are being made for another giant blast of a carbonate hillside.

Estimate has been made that the 3,000,000 tons of leached tailings here contain about 1,000,000 lb. of copper. Plans are being made to secure at least a part of this by infiltration with an acid solution and deposition below on iron scrap.

### JEROME, ARIZ.—May 24

**United Verde** has warmed up a couple of stacks at the Clarkdale smeltery and has resumed copper production on a limited scale, for the first time since Feb. 13, when closing at mine and works was forced by I. W. W. agitation. Work will be continued on measures for doubling smeltery capacity and for installation of a coal-crushing plant for the new fuel system. At the mine much is to be done on the new shaft and in perfection of plans for steam-shovel stripping of the old orebodies, in which fire has been known to exist for years. The working force now is about half the strength before the strike. All men employed hereafter will be given strict physical examination and only loyal citizens will pass inspection. Married men, former employees of good record, and soldiers will have preference, and "hiring and firing" no longer will be left to the caprice of foremen and shift bosses.

**United Verde Extension** is expected to start its blast furnace within 30 days, on a large reserve ore supply. Much remains to be done on the long-service tunnel and transportation system that will cut ore haulage costs in half. Mine operators of the camp are united in their consideration of labor problems.

United Verde Extension has been awarded a rebate of $200,000, to be paid within 30 days, by the Santa Fé, Arizona Eastern, Southern Pacific and El Paso & Southwestern railways, adjudged by the Arizona Corporation Commission to have been overcharged on ore shipments made by the plaintiff company from Clarkdale to Douglas. The railroads have assented to the judgment.

Of the 1,000,000 shares of outstanding Gadsden stock, 70% have been optioned to the Calumet & Arizona Mining Co. of Bisbee, in consideration of that company's agreement to develop the property.

### PHOENIX, ARIZ.—May 21

**New Rules Governing Stock Sales** in Arizona have been issued by the Arizona State Corporation Commission to the effect that all stock salesmen must exhibit to the prospective purchaser of stock a copy of the state corporation commissioners' permit authorizing the sale of the stock offered. The new regulations also state in part: "Hereafter, stock held in pool subject to our orders will be released upon application and a showing that such release will not work an injury to the public or to any party or parties in interest.

"Stock of investment companies required to be escrowed by the Arizona corporation must be escrowed in some bank or trust company in Arizona, approved by the commission, and in a form that will give the commission absolute and exclusive control over the release of such stock."

The new order also cancels the requirement providing for the announcement above all investment advertising matter that the corporation does not recommend the particular stock offered.

### BIRMINGHAM, ALA.—May 23

**Little Change in Operations** in the iron and steel industry has taken place in the third week in May, though the prospect of greater production and more sales is brighter than for the corresponding week in April. A shipment of 1000 tons of steel billets by the Gulf States Steel Co. during the third week of May is noted in the increase of sales. This steel was for export, going to Liverpool, England, and is to be followed soon by another shipment. A large overseas trade is being sought, and, as a reduction in ocean freight rates is being applied for by manufacturers in the district, with some hope of success, it is believed the Birmingham district will soon be shipping iron at a normal rate.

### SEATTLE, WASH.—May 24

**The Standard Oil Co. of New Jersey** has had its geologists quietly working through western Washington for the last several years, in search of possible new oil fields and has now decided to put down a test well at Moclips, Wash. Preliminary work is practically complete, machinery is now being assembled and the company expects to be drilling within a few weeks. Also, it is rumored that a second well will be drilled in the Upper Hoh River district, Jefferson County. This is the district picked by Charles E. Weaver, of the Washington State Geological Survey, as the most promising place for finding oil in this state. The Standard Oil's announcement has created considerable excitement, and a number of other enterprises are now being projected. Three years ago there was a considerable oil boom through the western part of the state, but it was unproductive. At present there are no producing wells in the state. It is reported that the Wylomont Gas and Oil Co., of Kentucky, will drill near Montesano, Washington.

### VICTORIA, B. C.—May 24

**The Dolly Varden Mine**, one of the most promising silver properties of the Alice Arm district, northern British Columbia, will, it is expected, be taken over by the Taylor Engineering Co. This concern constructed a railway from the coast to the mine, which incidentally taps a number of other good prospects. The Dolly Varden company failed to pay the engineering company all that was claimed for this work, and, by virtue of legislation passed at the last session of the Provincial Legislature, the first-mentioned company and the Temiskaming Mining Co. were given until May 19 to arrange for the liquidation of claims amounting to $462,500. This they have not done, apparently, and the Taylor Engineering Co. therefore has the power to take possession, its first responsibility or doing so being the discharge of wages due workmen, amounting to about $150,000. This done, the same concern has authority to proceed with the operation of the mine

# The Mining News

## ALASKA

ALASKA ENDICOTT MINING COMPANY (William Henry Bay)—Charles Mason passed through Juneau and stated company would go ahead soon with operations. Few repair parts for old equipment were taken in.

ALASKA TREADWELL (Treadwell)—Now working on 2800 level. This company has promising silver-lead property on Seward Peninsula, which is in charge of Jim Gwyn as superintendent. Equipment now being bought to operate property.

AT McGRATH, Thomas P. Aitken, a well-known placer miner, of Atlin, B. C., has taken over a gold-quartz claim and expects to take equipment in during June.

ALASKA GASTINEAU MINING (Thane)—According to reports of Mr. Hayden, of Hayden Stone & Co., the best company can expect this year is to break even. Has No. 11 stope in fair condition and caving should be less frequent.

ALASKA PEERLESS MINING (Windham Bay)—Sam Newswander in charge. Expects to operate, as men will be available from now on.

## ARIZONA

### Cochise County

COPPER QUEEN (Bisbee)—Stripping overburden of porphyry deposits of Sacramento Hill section by steam shovels. Tonnage estimated at 15,000,000, averaging 1½% copper. West section, being richer, to be milled first. Established special welfare department for Mexican workmen. Smeltery at Douglas in April handled 107 carloads, 4289 tons, of Nacozari concentrates.

MOORE-LETSON (Douglas) — Lead claims in Swisshelm mountains, north of Douglas, to be developed by Chicago Exploration and Development Company.

### Gila County

GIBSON (Bellevue)—Mill of 500 tons' capacity about 65% complete. Dumps said to contain several hundred thousand tons of 4% sulphide copper ore.

### Greenlee County

STARGO (Morenci)—Taken over by Arizona company, headed by M. J. Hannon, formerly of Bisbee. Shipments to be made to El Paso, but plans being made for cyanide mill.

### Santa Cruz County

ALTO (Patagonia)—Bonded from Hazeltine-Stone-Beatty firm by L. M. Tobin. Property is cut by Baca Float boundary line.

CONSOLIDATED ARIZONA (Patagonia)—Shaft on Olive group at 75 ft. has cut argentite. Talc on either side also carries valuable content. El Paso group has new shaft equipment. Lately visited by president, J. A. Ritzler, of Kansas City, accompanied by Alfred May and J. H. Snyder, of Gary, Indiana.

FLUX (Patagonia)—Raise from 130 level has cut orebody carrying silver, lead, and copper. Above 130 level has about 100,000 tons of carbonates unavailable for treatment under present conditions. F. B. Kollberg, manager, is sinking to develop sulphides. Mill erected.

FOUR METALS (Patagonia) — Near Mowry. To resume production.

RUBY (Patagonia) — Will sink new working shaft on basis of record of churn drilling.

THREE R (Patagonia)—R. E. Fishburn named as receiver in Tucson court, to protect claims of Tucson firm on leasing company, which has started erection of mill. Debts said to exceed $20,000. R. R. Richardson served notice of forfeiture of lease.

### Yavapai County

O'DONNELL (Clarkdale)—Working of claims 16 miles northwest indicate discovery of new gold districts; ore from shallow shaft development carries some copper. Santa Fe tracks cross group.

NELSON (Crown King)—G. P. Harrington, manager, driving main tunnel, now 300 ft., at rate of 5 ft. a day, to tap 950-ft. shaft. Tunnel parallels War Eagle and other developed veins, to be crosscut later. Three veins crosscut on Nelson ground. Already tunnel is furnishing water sufficient for operation of 20-stamp mill.

CONSOLIDATED ARIZONA SMELTING (Humboldt)—Last month's bullion shipments East were 770,000 lb. copper. Company's Blue Bell and De Soto mines produced 12,600 tons ore.

McGILLIGAN (Jerome) — Option on eight claims in southeastern corner of county taken by Houghton syndicate, represented by Luther E. Warde. Ore mostly copper, with some gold.

## CALIFORNIA

### Amador County

ARGONANT (Jackson)—Fire now confined to 4350-ft. level. Circulation in lowest levels will be provided through raises being driven. Most of burned territory includes only old stopes and caved ground. Little valuable ground has been affected.

### Calaveras County

SHEEPRANCH (Murphys) — Development under management of Eastern company reported to show encouraging results.

### Nevada County

GOLDEN CENTER (Grass Valley)—Work confined to 500 level, as pumping facilities insufficient to keep lower workings unwatered.

CHAMPION (Nevada City)—Good ore being developed below 1500 level.

ARTIC QUARTZ (Washington)—Plan to resume under management of J. P. Flint, Los Angeles.

GASTON (Washington)—Being reopened under management of W. L. Williamson. Ore medium grade; for several years the mine was steady producer.

OMEGA HYDRAULIC (Washington) — High water washed out barrier, which was of basket type. Ground sluicing of bed rock will proceed until dam is reconstructed. Controled by South Yuba Mining and Development Company.

### Sierra County

EL DORADO (Alleghany)—Machinery being installed by new company to sink shaft further.

LOST CAMP MINE (Dutch Flat)—Application made to California Debris Commission by John S. Day, B. J. Jeffry, and Murray Innes for permission to store debris in Woods Ravine, tributary of Blue Canyon Creek.

KATE HARDY (Forest)—Reported group of mines will be reopened on completion of examination by H. L. Valkenberg.

### Trinity County

BONANZA KING (Trinity Center) — Increased working force planned this summer.

ESTABROOK DREDGE (Trinity Center)—Within few weeks dredging should start, as last shipment of heavy machinery received.

### Tuolumne County

RAWHIDE (Jamestown)—News that Rawhide mine is to be worked was started when Central Land Co. filed notice of nonliability with County Recorder. Is one of the mines from which late Capt. W. A. Nevills made his fortune.

SPUR (Mount Lily)—Free gold ore reported by A. E. Caldwell. Half interest secured by Hampton, Miller, and Badger of Patterson, California.

LITTLE BONANZA (Sonora)—Optioned by Holbrook & Maguire, well-known chrome miners, who plan to open property at depth.

## IDAHO

### Shoshone County

MARSH (Burke) — Management announces exploratory work will begin about June 1, the company having funds to continue work during year. Engineer will make report to directors before that date. Sold hoist, from which it appears that work in shaft has been abandoned for present. Meeting of stockholders in Spokane elected Edward Pohlman, of Spokane, president; M. M. Lee, of Duluth, vice-president; Joseph McCarthy, of Spokane, secretary; J. V. Pohlman, of Spokane, treasurer, and these, with Fred L. Bergen, of Burke, Idaho, mine superintendent, constitute board of directors.

INTERSTATE-CALLAHAN (Wallace)—Announced work will resume on Nipsic group, opened by crosscut from No. 6 level of Interstate-Callahan, 2500 ft. Vein shows 12 in. good lead-silver ore. Tunnel, 1000 ft. above, has lead-silver orebody 120 ft. long and from 18 in. to 2 ft. wide. At New York meeting of directors, John A. Percival reëlected president, and H. T. McMeekin secretary-treasurer, both of New York. Decided against removal of main office from New York to Wallace.

REX (Wallace)—Ground above No. 1 level leased to Paul Meacham and others, of Wallace. Considerable body lead carbonate ore available, and lessees expect to open body of sulphide.

## MICHIGAN

### Copper District

SENECA (Mohawk) — Shaft sinking again and concreting work being done, as all of shaft must be concreted. No drifting yet done on Kearsarge lode, where cut by crosscut as this opening will be approached by raise. Still considering selection of mill site. Rumors of absorption of Ojibway without foundation.

MICHIGAN (Rockland) — Stamped in April, 5289 tons rock, from which return of 27.5 lb. copper per ton was secured.

### Gogebic Range

McKINNEY STEEL CO. (Bessemer)—Building new houses for employees in Ironton location.

NEWPORT (Ironwood)—In last month forces reduced by about 200 men. To date shipments from stockpiles have been small.

OLIVER IRON (Ironwood)—Investigating various shoveling machines for underground use, and may place order. Drifts about 7 x 8 ft. in the clear, and large machines are consequently impracticable.

### Menominee Range

ESCANABA DOCKS (Escanaba)—Total shipments iron ore from range in April as follows: C. & N. W. dock, 36,701 tons; C., M. & St. P. dock, 34,716 tons.

## MINNESOTA

### Cuyuna Range

CUYUNA-DULUTH (Ironton)—Sold iron ore stockpile, which remained unsold all of last season. Loading expected to start soon.

CUYUNA-MILLE LACS (Ironton) — Sinking shaft to deeper level, but no other work under way, and no intimation when this important manganiferous producer will start operations. Has 50,000 tons in stock.

FEIGH (Ironton)—Now at producing stage, all permanent equipment being installed. Has steel headframe, electric hoist, and compressor, and electric stockpile and underground haulage. Grading of spur track and stockpile grounds well under way.

MAHNOMEN (Ironton)—Clement K. Quinn open pit expects to make shipments of at least 150,000 tons this season. Has sold some tonnage of manganiferous material.

THOMPSON (Ironton)—Preparing to resume.

ADBAR (Trommald)—One diamond drill continuing exploration.

### Mesabi Range

AJAX (Biwabik)—Will reënter shipping list after shutdown lasting since 1906. Discovery of a deposit running high in manganese a feature of the new development. Federal Consolidated, Minneapolis, operators.

WOODBRIDGE (Buhl)—Officials of Fort Henry Mining Co., operators, seeking to cave a certain low-grade portion of mine to make better portions more accessible. Is a state lease, and state authorities reluctant to grant the request. Conference between mine and state officials held in St. Paul, May 22.

BILLINGS (Chisholm)—New property of Tod-Stambaugh Co. Completed 12 x 12 ft. main shaft to 260 ft. level; now drifting to orebody. Surface equipment completed; among most modern plants on range.

**Vermilion Range**

NORTH CHANDLER (Ely)—Working one shift only and hoisting one shift; 40,000 tons in stockpile.

PIONEER (Ely)—Producing 1700 tons daily; probably largest daily production of all mines in state. Oliver Iron Mining Co., operator.

## MONTANA

**Silver Bow County**

BUTTE COPPER AND ZINC (Butte)—Ore showing reported good last week on 1000 level east of Emma mine. James Brennan, superintendent.

BUTTE & PLUTUS (Butte) — Plutus shaft will be sunk from 160 to 400 ft. depth and Plutus and Norwich-Mapleton veins cut at depth of about 350 ft. Some ore being shipped.

DAVIS-DALY (Butte)—High-grade copper ore cut in raise from the 2300 of Colorado mine continuing. Approximately 10 ft. ore shown, with whole width averaging good copper contents and nearly three feet of high grade. Drifts continue in ore on lower levels, deposit being opened now more than 1100 ft. in length of practically continuous ore. Moving 30,000 yd. of old dump at Colorado mine to provide room for new ore bins, change houses and surface improvements. Contractors bid $1.50 per yd. for removal of dump, but company doing its own work, handling rock at 65c. per yd. Quarterly report for period ended Mar. 31 shows net profits of about $4000, being had from ore obtained in course of development work only. Mining of ore suspended pending metal-market improvement.

NORTH BUTTE (Butte)—Edith May vein on levels below 3000 ft. continue in ore. Showing 3200 reported good, and fair on 3400. Crosscutting continues on 900 of Sarsfield. Lester Frinck, superintendent.

TUOLUMNE (Butte)—Sinbad shaft of Main Range now down to 175 ft. below 800 and expected to be cutting station on 1000 by June 15; also crosscutting for Spread Delight fissure by July and expect to be in vein by Sept. 1. Estimated that 700 ft. croscutting on 1000 necessary to reach fissure. Mose Little, superintendent.

## NEVADA

**Nye County**

TONOPAH SHIPMENTS for the week ending May 10 amounted to 7185 tons, of estimated gross milling value of $122,145. Shippers were: Tonopah Belmont, 1860 tons Tonopah Mining, 1100; Tonopah Extension, 2100; West End, 1108; Jim Butler, 164; Montana, 223; Midway, 59; Tonopah Divide, 420; MacNamara, 210 tons.

## NEW JERSEY

**Morris County**

WHARTON STEEL CO. (Wharton)—Reported sold five tracts iron-ore properties in Rockaway township to Thomas Iron Co., operating in same district. Comprises Allen mine, Teabo mine, and unnamed locations. Total is close to 400 acres.

## NEW MEXICO

**Grant County**

J. E. DEVINE leased Coyle silver-lead property, expects to have car ore ready for shipment to El Paso smelter in 30 days.

EL ORO (Steins Pass)—Leased to L. E. Foster, of Silver City, N. M., formerly in charge steam-shovel work for Chino Copper Co. Will start development at once.

OCTO (Lordsburg)—Again started shaft sinking. E. K. Davis, superintendent.

VOLCANO (Steins Pass)—Leased from E. Smith by Sam Diggs, of Tucson. Is old silver property. Will sink main shaft from 100 level at once.

**Luna County**

VICTORIA MINES (Gage)—Will sink 400-ft. shaft. Spent $90,000 in development work. Will install additional machinery. Norman Welch, manager; J. T. Duryae, Brooklyn, N. Y., owner.

GAGE MINING (Gage)—Have unwatered 400 ft. shaft; two 4-ton trucks hauling ore; shipping to El Paso smeltery. Captain Soloman, manager.

**Sandoval County**

HAGAN coal fields reported purchased by United Sulphur Development Co., of New Orleans. J. J. DePreslin, president.

**Sierra County**

VIRGINIA (Kingston)—Developing rich vein silver ore recently struck. John H. Moffett, owner.

## NORTH CAROLINA

**Guilford County**

THE GARDNER HILL MINE, near Jamestown, sold to H. K. English, of Knoxville. Concentrator will be built to work dumps, containing copper and precious metals. Former producer. Few years ago unwatered and sampled. Several shipments made of ore picked from old dumps.

**Moore County**

THE OLIVER QUARTZ CO. (Hemp)—At work for some time developing Gerhart Brothers' talc mine. Prior to signing of armistice engaged in mining near Waderville, producing lump quartz for lining acid towers. Was one of largest producers in country. Also produced ground quartz in mill at Charlotte, N. C., which will now grind talc. Deposits may be related to those developed near Glendon. Mineral not true talc, but pyrophyllite, which is marketed for similar purposes.

## TEXAS

**Brazoria County**

GULF PRODUCTION (West Columbia)—Well No. 3 Eyers, on Block 27 of Park subdivision, came in May 15 at depth of 2960 ft., with initial flow of 2000 bbl.

HUMBLE OIL AND REFINING CO. (West Columbia)—Reported this company abandoned its Diggs Well No. 1 at 3965 ft. This well most easterly drilled in district.

THE TEXAS CO. (West Columbia)—Hog Well No. 15, on Block 24 of Park subdivision, came in May 16, flowing 3000 bbl. from depth of 2915 feet.

**Fort Bend County**

DEVELOPMENT OF BLUE RIDGE FIELD greatly stimulated by opinions of several Houston lawyers that leases granted by Bassett Blakely on his Blue Ridge farm subsequent to his giving 10-year option to purchase to State Prison Commission are legal. Held that rights of these lessees are guaranteed by the state through contract issued by commission to Bassett Blakely and approved by Governor. The Texas Co. has started rigging for test hole on Robbins 160 acres. Blue Ridge Oil Co. has been recently organized to drill at Blue Ridge.

**Hardin County**

LAKE GRAHAM OIL (Sour Lake)—No. 2 Bashara pumping 200 bbl. fluid mixture a day, 80% of which is oil, from depth of 2996 feet.

THE TEXAS CO. (Sour Lake)—No. 113 Fee, recently worked over, pumping 110 bbl. per day.

**Harris County**

COMPLETIONS IN GOOSE CREEK FIELD made recently as follows: The Texas Co., No. 12A Isenhour, pumping 50 bbl.; Crown Oil and Refining Co., Hog Island No. 1, salt water at 3400 ft.; Humble Oil and Refining Co., No. 39 Gaillard, bailing; Atlantic Oil and Refining Co., Goose Lake No. 1, bailing at 2750 ft.; Rucjer and associates, No. 1 Haskins, bailing at 1550 ft.

COMPLETIONS IN HUMBLE FIELD: The Texas Co., No. 26 Koehler, flowing in heads at rate of 200 bbl. daily; No. 235 Landslide of same company, pumping 35 bbl.; George Smith's No. 3 Bready, arranging to pump at 660 ft.; Webb Oil Co., No. 16 Cherry, arranging to pump at 610 ft.; several other wells abandoned or ran into salt water.

GULF PRODUCTION (Goose Creek)—No. 12 state-land well brought in recently with initial production of 150 bbl.

**Liberty County**

EMPIRE GAS AND FUEL CO. (Dayton)—No. 3 Jackson pump recently installed, and now producing from 30 to 50 bbl. daily. This is not full capacity, as storage capacity insufficient to receive more.

THE TEXAS CO. (Hull)—No. 1 Palmer well, completed at depth of 2400 ft., came in May 12 at rate of 5000-bbl. flow.

## UTAH

**Beaver County**

MILFORD-MAGNOLIA (Milford) — Reported fissure cut on 200 level 40 ft. out from shaft shows 4 ft. lead-silver ore, followed 15 feet.

**Juab County**

TINTIC SHIPMENTS week ended May 16, 144 cars; 18 shippers.

CHIEF CONSOLIDATED (Eureka) — New transformers and other equipment being installed to bring capacity to 5000 h.p. At present 1000 h.p. being used.

IRON KING (Eureka) — Preparing foundations for new hoisting plant for shaft sinking. Shaft to be sunk by contract.

**Salt Lake County**

SOUTH HECLA (Alta)—Shipped 400 to 500 tons from accumulated ore. Some trouble from inflow of surface water.

CARDIFF (Salt Lake)—Road from mine down Big Cottonwood impeded by snowslides, but expected clear for shipping June 1. New body ore varying from 5 to 10 ft. in width followed about 200 ft. Expected to begin work with small force, to be increased as shipping improves. Stated in condition to ship 75 to 150 tons daily.

MAXFIELD (Salt Lake)—Old property being worked by lessee.

**Tooele County**

WESTERN UTAH COPPER (Gold Hill)—Drifting being done to south on 700 level following three veins, one 2½ ft. wide, carrying silver-lead ore, shipping grade. O. F. Brinton, general manager.

**Utah County**

PROPERTIES BEING WORKED: Belerophon, Globe, Bog Iron (by Earle Eagle, which has lease), American Mining, one-half mile above Pacific, and Pacific.

## WISCONSIN

**Gogebic Range**

OGLEBY NORTON CO. (Montreal) — Has completed $70,000 clubhouse.

ASHLAND DOCKS (Ashland) — Total shipments from Gogebic Range, in Michigan and Wisconsin in April as follows: C. & N. O. W. dock, 139,100 tons; M., St. P. & S. Ste. M. dock, 8168 tons.

## CANADA

**Ontario**

APRIL SHIPMENTS of ore over the Temiskaming & Northern Ontario Ry. were: Buffalo, 181 tons; Coniagas, 113; Dominion Reduction, 70; Hudson Bay, 32; La Rose, 147; McKinley-Darragh, 167; O'Brien, 64; Penn Canadian 30; Casey Cobalt, 30; Miller Lake-O'Brien, 32, or a total of 868 tons. The above shipments were made to following: Deloro Smelting & Refining Co., Marmora Deloro, 421 tons; Coniagas Reduction Co., Thorald, 47; A. S. & R., Denver, 120; A. S. & R., Pueblo, 248; Pennsylvania Smelting Co., Carnegie, 30. The price of silver remained stationary during the month of April at 101.125c.

NIPISSING (Cobalt)—Development on 109 vein proved 170 ft. in length; high-grade ore. Management acquired interest in 1000 acres oil land south Petrolia oil and gas field 20 miles southeast Burkburnett oil pool in Texas. Will start drilling within 30 days.

CANADIAN KIRKLAND (Kirkland Lake)—Shareholders' meeting called for May 28, to ratify the agreement to option the property to Sir John Carson, representing the Crown Reserve.

HOHENAUR (Kirkland Lake)—To be developed. Mining plant being installed.

TECK HUGHES (Kirkland Lake)—In April milled 2602 tons of ore and recovered $27,217, or an average of $10.46 a ton.

PITTSBURG LORRAIN (Lorrain)—Will reopen and treat old tailings from Wettlauffer mine.

**Quebec**

INDIAN PENINSULA (Hurricanaw)—Completed mill for treatment of molybdenum ores. Present situation with regard to this mineral unfavorable, but officials look for improvement.

## COLOMBIA

TAX ON PLATINUM amounting to 5% will be imposed on exports after June 15. Exports of gold will be prohibited as long as the existing restrictions on such exports are in force in Europe and the United States. When gold has been imported from Europe and United States, permits will be granted for exportation of equal amount in substitute therefor. No change in the export duty on gold.

# The Market Report

### SILVER AND STERLING EXCHANGE

| May | Sterling Exchange | Silver New York, Cents | Silver London, Pence | May | Sterling Exchange | Silver New York, Cents | Silver London, Pence |
|---|---|---|---|---|---|---|---|
| 22 | 4.6225 | 105¼ | 51½ | 26 | 4.6400 | 106½ | 51⅝ |
| 23 | 4.6375 | 106½ | 51⅝ | 27 | 4.6375 | 107⅜ | 52⅛ |
| 24 | 4.6400 | 105⅝ | 51⅜ | 28 | 4.6375 | 108¼ | 52⅛ |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

### DAILY PRICES OF METALS IN NEW YORK

| May | Copper Electrolytic | Tin Spot. | Lead N. Y. | Lead St. L. | Zinc St. L. |
|---|---|---|---|---|---|
| | | | 5.20 | 5.00 | 6.20 |
| 22 | 16.35 | †72½ | @5.30 | @5.05 | @6.25 |
| | | | 5.20 | 5.00 | 6.20 |
| 23 | 16.35 | †72½ | @5.30 | @5.05 | @6.25 |
| | | | 5.20 | 5.00 | 6.20 |
| 24 | 16.35 | †72½ | @5.30 | @5.05 | @6.25 |
| | | | 5.15 | 4.90 | 6.17½ |
| 26 | 16.35 | †72½ | @5.25 | @5.00 | @6.22½ |
| | | | 5.15 | 4.90 | 6.15 |
| 27 | 16.35 | †72½ | @5.25 | @5.00 | @6.20 |
| | | | 5.15 | 4.85 | 6.12½ |
| 28 | 16.35 | †72½ | @5.25 | @4.90 | @6.15 |

† Government price.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

### LONDON

| May | Copper Standard Spot | Copper Standard 3 M. | Copper Electrolytic | Tin Spot | Tin 3 M. | Lead Spot | Lead 3 M. | Zinc Spot |
|---|---|---|---|---|---|---|---|---|
| 22 | 79⅜ | 79¾ | 82½ | 236 | 232½ | 23½ | 23¾ | 36½ |
| 23 | 78½ | 78.85 | 82½ | 233¼ | 229 | 23½ | 23¾ | 36½ |
| 24 | .... | .... | .... | .... | .... | .... | .... | .... |
| 26 | 78¾ | 79 | 82 | 236 | 230½ | 23½ | 23½ | 36½ |
| 27 | 79⅜ | 79¾ | 82 | 237 | 231 | 23 | 23½ | 35¾ |
| 28 | 79¼ | 79½ | 82 | 235 | 230 | 22¾ | 23 | 36 |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

## Metal Markets

**NEW YORK, May 28, 1919**

The metal markets became quiet all around this week and exhibited rather a drooping tendency. This was the case not only with lead and spelter, but also with copper. The great buying movement of April and May in copper seems to have exhausted itself for the time being.

Transatlantic freight rates remain unchanged at 1c. per lb. to British ports, while probably 1¼c. to French ports and to Antwerp would have to be paid. The freight rate from San Francisco to Hong Kong and Kobe has come down to $14 per ton.

In the "Journal" of May 24, the silver prices at New York for May 17 and 19 did not show clearly, owing to defective printing. The prices on those days were $1.10⅜ and $1.09½, respectively.

## Copper, Tin, Lead and Zinc

**Copper**—The great buying movement of April and May seems to have exhausted itself about May 20, since when sales have been relatively light. During the last week the total was very much less than that of the previous week, and, even so, there was no generally distributed business, a large part of what was reported being represented by a few transactions of more or less special character. Producers made sales of 16¼c., regular terms, corresponding with 16.35c., cash, New York, up to May 26, inclusive. Included in these sales was one round lot for June-August delivery, which was taken at the price commonly quoted for June alone. Since May 26 producers made none but trifling sales and there were offerings on the market through brokers at concessions in prices, say, at 16¼c., New York, and perhaps lower. There is known to be considerable copper in speculative hands, whence such offers to sell may emanate. So far, however, these offerings have been of too small quantities for us to regard them as quotational, and for the last two days of the week we report the market nominally unchanged at 16.35c. Nevertheless, these offerings, whatever their character, attract attention.

With the end of the big buying movement of April and May we are able to appraise its character better than heretofore. Sales for April, large as they were, fell far short of the production in that month. The sales for May were larger and came pretty close to the present rate of production. Nevertheless, there was a further accumulation of stocks during May, for deliveries were not so large as the sales, the latter covering anticipated requirements for some time ahead. There were some sales for export, but by far the major part of the business was done with domestic manufacturers, and especially with wire-drawers. However, a considerable part of the copper taken by them was destined for export ultimately, inasmuch as some considerable sales to Europe of rods and wire were made. This means that Europe bought copper in semi-manufactured forms, instead of wire-bars, through the Export Association.

It is wholly a matter of conjecture as to what extent manufacturers bought copper against orders already in their hands, and to what extent they bought simply to lay in copper for anticipated orders, on the theory that at recent prices the metal was cheap. We judge that the major part of the business was against actual orders, but a considerable part was anticipatory. As things stand now, manufacturers probably have covered about all of their requirements for June and a considerable part of what they will need or expect to need in July, while contracts have been entered into for a relatively small quantity of August copper.

The agents of the Export Association quoted £83 in England on May 22, advanced to £83¾ on May 23, and later went up to £85, the advances corresponding more or less with the decline in sterling exchange. With exchange at 4.64, the equivalent of £85 would be about 17¾c., c.i.f., or about 16.35c., f.a.s. here. However, American copper cannot be sold in England at those prices, while the copper over there is quoted at £82 for spot, and £83 for futures.

The Comité Central Industrial de Belgique, the unofficial organization which was charged by the Belgian Government with the collection of information regarding the destruction of property in Belgium, estimates that during the first three months of resumption of industry the requirement of copper for reconstruction will be about 15,000 metric tons.

**Copper Sheets**—The base price of copper sheets is 24c. per lb. Copper wire is quoted at 18¾@18¾c.

**Tin**—On May 24, George Armsby, chief in charge of tin, War Industries Board, issued the following letter to the trade:

"On May 1, 1919, according to reports made to the American Iron and Steel Institute, the supply of tin, (including tin content of tin ores and concentrates) on hand in the United States, in the hands of consumers, jobbers, dealers, and smelters, and the unsold portion of the Inter-Allied tin, was approximately 22,000 tons. Up to May 1, 1919, 6863 tons of the 10,169 tons of Inter-Allied tin allocated to the United States had been disposed of. Since May 1, a further 1107 tons has been sold, leaving a balance unsold on May 23 of 2199 tons. During January, February, March and April, 1919, the average monthly consumption of tin in the United States, as reported to the American Iron and Steel Institute, was 3713 tons."

It has been desired for a long time that the Government should make a statement of the statistical position, and the letter of May 24 was doubtless issued in deference to that proper desire. It would be even more desirable if Mr. Armsby should be more explicit, especially with respect to the relative quantities of tin in ore and in metal, and, as to the latter, how much is in the hands of consumers and how much in other hands. However, the published figures showing a total of approximately 22,000 tons in all forms were viewed quite bearishly in the trade.

**Lead**—A fair business continued during the first three days of this week, but beginning with Monday there was a decided falling off, and immediately there began to be cutting of prices, some of which probably reflects certain interesting conditions. The declining tendency of the price for lead in England attracted attention. In this market there was evinced a rather strong desire to dispose of future lead even at sharp concessions, and at the close lead for July delivery was offered at 5½c.

The lead situation in this country has without any doubt improved statistically. The chief question at the moment is whether it has improved enough and whether foreign conditions, which lately have afforded an outlet for Mexican lead, will continue to abate that threat against our market. The production of lead in the United States probably declined to a moderate figure in May, and probably stocks in the hands of producers diminished. Certainly some important producers report themselves in quite a comfortable position statistically.

Lead manufacturers report a noteworthy increase in business in plumbing fittings, reflecting the building of numerous small houses, but the pipe business as a whole is subnormal. The sheet-lead business is also subnormal.

**Zinc**—With the rise in the price last week, the market met the selling of producers, who, having previously overstayed their market, welcomed the opportunity to relieve themselves. Although a moderately fair demand continued, there were more sellers than buyers, and the price declined rather easily. There were some small sales for export to England, which will probably go out via Galveston, and on May 27 galvanizers bought moderate tonnages. This morning business was done at 6.15c. and in the afternoon at 6¼c. There was some further export business in high-grade zinc, which was quoted at 6⅞c.

**Zinc Sheets**—The quoted price of zinc sheets is $10 per 100 pounds.

## Other Metals

**Aluminum**—Virgin metal in good demand at 33c. per pound.

**Antimony**—There was a further advance in this metal, which in the early part of the week was sold at 8¼c., and later at 8⅜@8½c., which we quote at the close. Most of the import houses made no offers of antimony for future delivery, but in some quarters June shipments were quoted at 8½c., New York.

**Bismuth**—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

**Cadmium**—Quoted at $1.40 per lb. in lots of 500 pounds.

**Nickel**—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

**Quicksilver**—The shortage of supplies in the New York market became acute, and the price advanced to $92. San Francisco telegraphs $87, strong.

## Silver and Platinum

**Silver**—After two weeks of excitement and wide fluctuations in price consequent upon the unexpected removal of Federal restrictions on export and price of silver, the market steadied itself at 51¼d. in London and has shown an advancing tendency since, closing at 52⅛d. in London on May 28. The supply of silver offering is limited and the demand is good. The outlook from India and China warrants a bullish feeling.

Mexican dollars at New York, May 22, 79½; May 23, 80½; May 24, 80; May 26, 81; May 27, 83; May 28, 83½.

**Platinum**—Refined ingot was in good demand at $105.

**Palladium**—Sales were made at $120.

## Zinc and Lead Ore Markets

**Joplin, Mo., May 24**—Blende, high, $44.20; basis 60% zinc, premium, $41; Prime Western, $40; sludge, $37.50; flotation, $35; calamine, basis 40% zinc, $25@22. Average settling prices: Blende, $36.28; calamine, $22.20; all zinc ores, $36.10.

Lead, high, $64.30; basis 80% lead, $60 @57.50; average settling price, all grades of lead, $56 per ton.

Shipments the week: Blende, 5669; calamine, 173; lead, 1430 tons. Value, all ores the week, $543,590.

Smelteries closed down by striking workmen some time ago have not been restarted, reducing the production of spelter in Oklahoma. Mines that were to close down this month will continue in operation for a few weeks, keeping the mines drained awaiting proof of the permanency of the higher prices being now offered for ores. Buyers are finding it almost impossible to fill orders, on account of the restricted output.

**Platteville, Wis., May 24**—Blende, basis 60%, $41 base, both for premium grade and high-lead grade. Lead ore, basis 80% lead, $54 to $56 per ton.

Shipments reported for the week were 2012 tons blende, 40 tons galena, and 336 tons sulphur ore. For the year to date the totals are 39,783 tons blende, 1897 tons galena, and 4964 tons sulphur ore.

During the week 3354 tons blende was shipped to separating plants.

## Other Ores

**Molybdenum Ore**—No business reported.

**Tungsten Ore**—Chinese ore was still purchasable at $7. Business in high-grade Bolivian ore was done at $9@10.25. In general there was a distinctly better tone in this market.

## Other Minerals

**Pyrites**—Spanish pyrites is quoted at 20c. per unit for furnace ore and 18c. for unbroken ore, c.i.f., New York or other Atlantic port.

## Iron Trade Review

**PITTSBURGH—May 27**

A further and marked increase in the volume of steel orders being placed is to be recorded. The first improvement was noted in this report last week, the turn occurring between ten days and a fortnight ago. The change is purely in the volume of purchases, there being no difference in the character of buying or in delivery periods, except that there has been a little contracting for bars for third quarter. Testimony is uniform that the buyers are the same as formerly, purchases being for jobbing distribution and ordinary manufacturing consumption. Orders for steel for construction purposes are not in evidence.

The improved demand for steel evidently reflects increased general business activity and does not indicate the inception of new building projects, except, of course, dwelling-house construction, which is on the increase.

The increase in buying may be approximately sufficient to arrest the decline in mill operations that has proceeded steadily since early in the year, and to cause an increase. Steel production averaged 77% of capacity in March and 65% in April, the rate at the present being probably 55%, or a trifle less. In the case of a number of producers the current bookings, including both new orders and specifications against contracts, are running at more than 60% of capacity. As practically all the buying is for immediate deliveries, there is no reason to suppose that it will not continue, except that there may be a slackening in July and August, which normally are dull months.

Two things are noteworthy: First, that it was a common prediction, toward the close of the war, that about six months would be required for readjustment, before there would be really active business, and such a period has expired, the present improvement dating almost precisely from a time six months after the armistice was signed; and, second, that there is no activity worth mentioning in the direction of new construction involving the use of steel, which is always necessary in order to afford full operation for the steel industry. As noted in previous reports, a great deal of construction work has been figured upon, but there is no disposition as yet to let contracts.

An exception to the general character of the steel buying, that it is only for immediate deliveries, is the fact that some steel-bar contracts have been made in the past few days for third quarter. No price guarantee is given, but if an accident should happen to the market the buyers could withhold specifications.

There are diverse influences as to prices. On the one hand, the improvement in the general tone of the market has encouraged the leading interests that were committed to the idea that prices should be maintained, and they are even stronger than formerly in that position. On the other hand, the appearance of greater demand has given encouragement to mills that were disposed to cut prices, and considerable price cutting is occurring in nearly all finished-steel products. Thus far at least the general stability of the market is not threatened. The probability is that Mar. 21 prices will be maintained, nominally at least, for several months. If construction work, including railroad rehabilitation and expansion, does not begin at these prices, and it is made clear that a start could be produced by lowering prices, the steel market will probably be thrown open, but the real test as to this cannot come before next autumn and perhaps not until next year.

**Pig Iron**—The pig-iron market continues stagnant, with transactions confined to small lots, which go at regular prices or at slight concessions. Merchant production is now light, and it is possible consumption exceeds production. Few furnaces are accumulating iron. Though soft, the market is quotable at former prices: Bessemer, $27.95; basic, $25.75; malleable, $26.25; foundry, $26.75; forge, $25.75, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh. One furnace interest with $1.10 freight to Pittsburgh also quotes these prices at furnace.

**Ferromanganese**—The market continues quiet, with resale 80% at about $110, delivered, though this price has been shaded in some instances. Makers quote $150, which is nominal. Stocks, however, are steadily being exhausted and a regular market will have to be developed soon. This can hardly be at the present $150 asking price of producers, as even imported material is available at much less, perhaps at about $116 at seaboard. Spiegeleisen remains about $33@35 for resale 18%, with no transactions reported.

**Coke**—Connellsville coke production has dwindled to almost insignificant proportions, about 80,000 tons a week, or one-fourth the rate during nearly all of last year. Byproduct production has decreased little. Spot Connellsville furnace coke is quoted usually at $4, but this price could probably be shaded 10 to 20c. Second-half contracts should be under negotiation soon, but furnaces are showing little interest. Foundry coke is stronger, at $4.50@5, depending on brand.

### MONTHLY AVERAGE PRICES OF METALS

| Silver | New York | | | London | | |
|---|---|---|---|---|---|---|
| | 1917 | 1918 | 1919 | 1917 | 1918 | 1919 |
| Jan. | 75.630 | 88.702 | 101.125 | 36.682 | 44.356 | 48.438 |
| Feb. | 77.585 | 85.716 | 101.125 | 37.742 | 42.792 | 48.027 |
| Mar. | 73.861 | 88.082 | 101.125 | 36.410 | 43.620 | 48.171 |
| April | 73.875 | 95.346 | 101.125 | 36.963 | 47.215 | 48.886 |
| May | 74.745 | 99.505 | ..... | 37.940 | 48.980 | ..... |
| June | 76.971 | 99.500 | ..... | 39.065 | 48.875 | ..... |
| July | 79.010 | 99.625 | ..... | 40.110 | 48.813 | ..... |
| Aug. | 85.407 | 100.292 | ..... | 43.418 | 49.077 | ..... |
| Sept. | 100.740 | 101.125 | ..... | 50.920 | 49.500 | ..... |
| Oct. | 87.332 | 101.125 | ..... | 44.324 | 49.500 | ..... |
| Nov. | 85.891 | 101.125 | ..... | 43.584 | 48.969 | ..... |
| Dec. | 85.960 | 101.125 | ..... | 43.052 | 48.492 | ..... |
| Year. | 81.417 | 96.772 | ..... | 40.851 | 47.516 | ..... |

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

### STOCK QUOTATIONS

| N. Y. EXCH.† May 27 | |
|---|---|
| Alaska Gold M. | 3⅛ |
| Alaska Juneau | 2⅛ |
| Am.Sm.&Ref.,com. | 81⅛ |
| Am.Sm. & Ref., pf. | 107¼ |
| Am.Sm.Sec., pf., A | ‡93 |
| Am. Zinc | 17 |
| Am. Zinc, pf. | 50½ |
| Anaconda | 70½ |
| Batopilas Min. | 2 |
| Bethlehem Steel | 79½ |
| Butte & Superior | 25 |
| Butte Cop. & Zinc | 13⅞ |
| Cerro de Pasco | 45 |
| Chile Cop. | 25⅞ |
| Chino | 40 |
| Colo. Fuel & Iron | 47⅛ |
| Crucible Steel | 80¾ |
| Crucible Steel, pf. | 100 |
| Dome Mines | 14½ |
| Federal M. & S. | 16⅛ |
| Federal M. & S., pf. | 44 |
| Great Nor., ore ctf. | 4 |
| Greene Cananea | 44 |
| Gulf States Steel | 73¼ |
| Homestake | 85 |
| Inspiration Con. | 59 |
| International Nickel | 28½ |
| Kennecott | 26⅛ |
| Lackawanna Steel | 84 |
| Mexican Petrol. | 182½ |
| Miami Copper | 28 |
| Nat'l Lead, com. | 77⅞ |
| National Lead, pf. | 109 |
| Nev. Consol. | 17¼ |
| Ontario Min. | 8¼ |
| Ray Con | 23 |
| Republic I.&S., com. | 87¼ |
| Republic I.&S., pf. | 104 |
| St. Joseph Lead | 14 |
| Sloss-Sheffield | 63 |
| Tennessee C. & C. | 14⅜ |
| U. S. Steel, com. | 107⅞ |
| U. S. Steel, pf. | 115⅜ |
| Utah Copper | 80½ |
| Va. Iron C. & C. | 67 |
| Worthington Pump | 69½ |

| BOSTON CURB* May 27 | |
|---|---|
| Boston Ely | 2⅛ |
| Boston & Mont. | .70 |
| Butte & Lon'n Dev. | .15 |
| Calaveras | 1⅛ |
| Chief Con. | 3⅛ |
| Contact | .05 |
| Cortez | .15 |
| Crown Reserve | .35 |
| Crystal Cop. | .12 |
| Eagle & Blue Bell | 2⅛ |
| First Nat. Cop. | 1⅛ |
| Gadsden Cop. | ⅜ |
| Houghton Copper | .75 |
| Intermountain | ‡.05 |
| Iron Blossom | .38 |
| Iron Cap | 1.01 |
| Majestic | .19 |
| Mexican Metals | .19 |
| Mines of America | ‡.05 |
| Mojave Tungsten | .20 |
| Nat. Zinc & Lead | .12 |
| Nevada-Douglas | .12 |
| New Baltic | 1 |
| Oneco | .50 |
| Pacific Mines | ‡.25 |
| Rex Cons. | .14 |
| Yukon Gold | .75 |

| SAN FRAN.* May 27 | |
|---|---|
| Alta | ‡ .08 |
| Andes | .30 |
| Best & Belcher | .20 |
| Caledonia | .24 |
| Challenge Con. | ‡ .03 |
| Confidence | .25 |
| Con. Virginia | 1 .95 |
| Gould & Curry | .10 |
| Hale & Norcross | .25 |
| Jacket-Cr. Pt. | .20 |
| Mexican | .52 |
| Occidental | .40 |
| Ophir | 1.55 |
| Overman | .10 |
| Savage | .20 |
| Sierra Nevada | .15 |
| Union Con. | .35 |
| Utah Con. | ‡ .04 |
| Belmont | ‡3.50 |
| Jim Butler | .37 |
| MacNamara | .98 |
| Midway | .46 |
| Mcnt.-Tonopah | .20 |
| North Star | .09 |
| Rescue Eula | .22 |
| West End Con. | 2.05 |
| Atlanta | .04 |
| Booth | .09 |
| Comb. Frac. | .04 |
| Florence | .40 |
| Jumbo Extension | .13 |
| Kewanas | .03 |
| Nevada Hills | .06 |
| Nevada Packard | .20 |
| Round Mountain | .39 |
| Silver Pick | .07 |
| White Caps | .18 |

| COLO. SPRINGS* May 27 | |
|---|---|
| Cresson Con. | 4.50 |
| Doctor Jack Pot | ‡.03 |
| Elkton Con. | .05 |
| El Paso | .17 |
| Gold Sovereign | ‡.02 |
| Golden Cycle | 1.74 |
| Granite | .14 |
| Isabella | .05 |
| Mary McKinney | .07½ |
| Portland | 1.00 |
| United Gold M. | .15 |
| Vindicator | .30 |

| BOSTON EXCH.† May 27 | |
|---|---|
| Adventure | 1¼ |
| Ahmeek | 76 |
| Algomah | ‡.60 |
| Allouez | 39½ |
| Ariz. Com. | 13¼ |
| Arnold | ‡.20 |
| Bingham Mines | 9⅛ |
| Bonanza | ‡.20 |
| Butte-Balaklava | .60 |
| Calumet & Ariz. | 65½ |
| Calumet & Hecla | 410 |
| Carson Hill | ‡13½ |
| Centennial | ‡13 |
| Copper Range | 47½ |
| Daly West | ‡3½ |
| Davis-Daly | 6⅛ |
| East Butte | 11¼ |
| Franklin | 3 |
| Granby | ‡66½ |
| Hancock | 5½ |
| Hedley | ‡12 |
| Helvetia | 5½ |
| Indiana | ‡ 50 |
| Isle Royale | 32 |
| Keweenaw | 1½ |
| Lake | 4⅛ |
| La Salle | 3½ |
| Mason Valley | 3⅛ |
| Mass | 5¼ |
| Mayflower | 9 |
| Michigan | 7 |
| Mohawk | 65 |
| New Arcadian | 2½ |
| New Cornelia | 19½ |
| New Idria | 10½ |
| Nipissing | 12⅛ |
| North Butte | 12½ |
| North Lake | .90 |
| Oilway | 2½ |
| Old Dominion | 38 |
| Osceola | 55 |
| Quincy | ‡66½ |
| St. Mary's M. L. | ‡18½ |
| Santa Fe | ‡.25 |
| Seneca | 25 |
| Shannon | 3½ |
| Shattuck-Ariz. | ‡11 |
| So. Lake | 1½ |
| So. Utah | .27 |
| Superior | 7½ |
| Superior & Bost. | 3 |
| Trinity | 3½ |
| Tuolumne | 1⅛ |
| U. S. Smelting | 69 |
| U. S. Smelting, pf. | 49½ |
| Utah Apex | 3⅛ |
| Utah Con. | 10½ |
| Utah Metal | 2¼ |
| Victoria | 2½ |
| Winona | 1⅛ |
| Wolverine | 19½ |

| N. Y. CURB† May 27 | |
|---|---|
| Am. Tin & Tung | ‡⅛ |
| Big Ledge | ¾ |
| Butte & N. Y. | ⅛ |
| Butte Detroit | .03 |
| Caledonia | .38 |
| Calumet & Jerome | ⅛ |
| Can. Cop. Corpn | 1⅛ |
| Carlisle | ‡2 |
| Cashboy | .10 |
| Con. Ariz. Sm. | 1⅛ |
| Con. Coppermines | 5⅛ |
| El Salvador | 4½ |
| Goldfield Con. | .18 |
| Goldfield Merger | ‡.05 |
| Hecla Min. | 5½ |
| Howe Sound | 4⅛ |
| Jerome Verde | ‡⅛ |
| Louisiana | ⅛ |
| Magma | ‡31 |
| Marsh | .08 |
| McKinley-Dar-Sa | .62 |
| Milford | ‡.75 |
| Mother Lode | .44 |
| Nixon Nevada | .21 |
| Ohio Cop. | ‡.50 |
| Rawley | ‡2½ |
| Ray Hercules | ‡2 |
| Richmond | ‡.50 |
| Rochester Mines | .22 |
| Standard S. L. | ⅛ |
| Stewart | .25 |
| Success | ‡.05 |
| Tonopah | 3½ |
| Tonopah Divide | 9⅛ |
| Tonopah Ex. | 2⅛ |
| Tribullion | ‡.25 |
| Troy Arizona | ‡.10 |
| United Eastern | 4⅛ |
| United Verde Ext. | .39 |
| United Zinc | ‡.25 |
| Utica Mines | ‡.08 |

| TORONTO* May 27 | |
|---|---|
| Adanac | .20 |
| Bailey | .03 |
| Beaver Con. | .45 |
| Chambers Ferland | ‡.10 |
| Coniagas | 2.60 |
| Hargraves | .04 |
| Kerr Lake | 5.75 |
| La Rose | .25 |
| Lake Shore | 1.00 |
| Min. Corp. of Can. | 2.00 |
| Peterson Lake | .07 |
| Teck-Hughes | .15 |
| Temiskaming | .40 |
| Wettlaufer-Lor. | .03 |
| Davidson | ‡.68 |
| Dome Exten. | .30 |
| Dome Lake | .20 |
| Hollinger | 6.75 |
| McIntyre | 1.75 |
| Newray | .12 |
| Porcu. Crown | .30 |
| Vipond | .20 |
| West Dome | .13 |

*Bid prices. †Closing prices. ‡Last quotations.